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PHO-TR470

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MISSION CONTROL CENTER  
PROGRESS REPORT  
**CASE FILE  
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CONTRACT NAS 9-1261

1 OCTOBER THRU 31 DECEMBER 1969

PREPARED FOR  
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
MANNED SPACECRAFT CENTER

**PHILCO** 

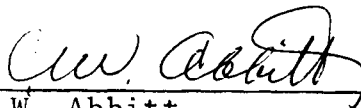
Philco-Ford Corporation  
Electronics Group  
Houston Operation  
1002 Gemini Avenue  
Houston, Texas 77058

MISSION CONTROL CENTER  
PROGRESS REPORT  
FOR  
1 OCTOBER THRU 31 DECEMBER 1969

Contract NAS 9-1261

Prepared for  
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
MANNED SPACECRAFT CENTER  
Houston, Texas

Approved by:

  
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MCC Program Manager

PHILCO-FORD CORPORATION  
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## FOREWORD

The Quarterly Progress Report of the Mission Control Center (MCC) Program is submitted in accordance with Article X, Paragraph (a) of Schedule III, Modification No. 67 to Contract NAS 9-1261, as extended by Schedule III First Option Modification No. 80.

This report has been prepared and submitted by Philco Houston Operations (PHO) for the period from 1 October through 31 December and covers the remaining Schedules I, II, and III effort, as well as the current Schedule III First Option effort under Modification No. 80 to Contract NAS 9-1261.

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PHO-TR470

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## SECTION 1

### PROGRAM SUMMARY

#### 1.1 ACCOMPLISHMENTS DURING OCTOBER, NOVEMBER, AND DECEMBER

- A. A full schedule of Mission H-1 validation tests, simulations and pad tests was successfully supported during the first half of the quarter prior to launch on 15 November. Emphasis was placed on MCC intersystem data flow training, contingency planning and simulated equipment problems for M&O personnel and instrumentation operators, to improve trouble isolation and system restoration responses should an intersystem problem develop during the Apollo 12 flight. Standby MCC engineering support was also available in the event of an emergency. During the 10 days of mission support, MCC systems performed at their highest level of effectiveness. There were no losses of critical data nor interruptions to critical communications due to MCC failures.

Documentation of the MCC configuration for Mission H-2 was issued on 21 November. Reconfiguration was not started until 9 December to permit critical CCATS program development testing prior to start of installation of the CCATS System Configuration Unit (SCU). Reconfiguration and associated testing were completed on 16 December.

Except for a 34-hour shut-down at Christmas, MCC support to ALSEP-1 has been continuous since deployment on 19 November.

- B. The CCATS SCU was delivered to Building 30 on 5 December. Engineering check-out was completed on 22 December and prequalification testing on 29 December. Interface mods were tested on 30 December, and the system was turned over to FOSO for scheduling effective 31 December. Effort remaining consists of delivery of 22 replacement printed circuit boards in January. Delivery of M&O spares will begin in January and be completed in June. (Adequate spares will be available for the H-2 mission.)

The digital television equipment 8-channel cluster is 90 percent fabricated, with all cabinets in the testing phase. The expected ship date from Hazeltine is 27 March 1970. Previously reported printed circuit board problems have been corrected and replacement boards are being manufactured. The final design review was successfully conducted on 17 and 18 December.

A specification is being prepared for a color converter to ~~convert the sequential field television signal from the spacecraft to the standard network format.~~ Preliminary vendor responses were solicited and received during December. Recommended specifications will be submitted to NASA in January.

During the quarter 52 EO's were received and 6 were cancelled. Sixty-three EO's were completed (13 Schedule II, 36 Schedule III, 14 Schedule III, Option 1), leaving 308 EO's in the system (21 Schedule II, 164 Schedule III, 123 Schedule III, Option 1). Fifty Mission H-1 EO's were completed. Ten H-2 EO's were completed, leaving 22 H-2 EO's open.

- C. All operational support tasks met schedule milestones. The Apollo Instrumentation Operations task and the PSRD task were combined into a Requirements and Instrumentation Operations task under Mr. John W. Hatcher.

The substantial reduction in manpower authorized for the Display Format and Slide Production task is possible only if certain NASA-furnished equipment is available to project personnel. Problems encountered during the quarter seriously reduced the availability of this equipment and, if allowed to continue, will degrade our D/TV slide-making ability.

- D. Negotiations were completed on NAS 9-1261 staffing for the contract period. Phase-down to final Option 1 manning levels has essentially been completed.
- E. During the upcoming quarter, emphasis will be placed on:
- MCC readiness for Mission H-2 simulation
  - CCATS SCU preparations (M&O training and logistics support)

- MCC readiness for Mission H-2 flight
  - Intersystem trouble isolation and restoration exercises.
- F. The MCC readiness cycle and priority EO's required for Mission H-2 are listed in the attachment.

# MISSION READINESS

AS-508 H-2

PARA. NO.	TASK	SCHEDULE	ACTUAL	COMMENTS
IA7-A	DISPLAY AND TM RECONFIGURATION	12/10/69	12/10/69	
IA7-B	COMMUNICATION RECONFIGURATION	N/A	N/A	
IA7-C	ASCATS RECONFIGURATION	12/17/69	12/9/69	
IA7-D	RECONFIGURATION TESTING	12/17/69	12/16/69	
IA7-F	MCC HARDWARE VALIDATION TEST MAN.	12/10/69	12/5/69	
IA7-G	PCM PROGRAM W/O DATA ROUTING	N/A	N/A	
IA7-H	M AND O OPERATING PROCEDURES	1/6/70		
IA7-I	PCM PROGRAM WITH DATA ROUTING	12/10/69	12/11/69	
IC2-F	TR 155 MASTERS	12/23/69	12/10/69	
IC4-A	MCC BASELINE HARDWARE CONFIGURATION	3/13/69	3/13/69	
IC4-D	PRIMARY LISTINGS	11/21/69	11/21/69	
IC4-E	SECONDARY LISTING	12/23/69	11/21/69	
IC4-F	TR 155	1/12/70	12/31/69	
IC4-G	CROSS CONNECT LISTS	11/21/69	11/21/69	
IC4-J	CONFIGURATION ORACT TEST LISTINGS	12/10/69	12/11/69	
IC4-K	CONFIG. ORACT TEST PACKAGE PROCED.	12/15/69	12/15/69	
ID1-B	QA SYSTEMS SURVEY REPORT	2/25/70		
II2-C	TM DATA FORMAT CONTROL BOOK	12/17/69	12/17/69	Rev. 3
	CMD DATA FORMAT CONTROL BOOK	10/9/69	10/9/69	Rev. 4, Change 4
	TRK DATA FORMAT CONTROL BOOK	8/5/69	8/5/69	Rev. 4
II2-D	APCU PROGRAM SPECS	10/1/69	10/1/69	
	GSSC PROGRAM SPECS			
	SSB-400-GSSC GENERAL SPECS	10/7/69	10/7/69	Rev. A
	SSB-402-GSSC LM SPECS	10/29/69	10/29/69	Rev. A
	SSB-401-GSSC SATURN SPECS	12/15/69	12/22/69	Rev. A, Change 1
	SSB-403-GSSC CSM SPECS	12/9/69	12/9/69	Rev. 1, Change 1
II2-E	SSB-404-GSSC DISPLAY SPECS	10/23/69	10/23/69	Change 3
	CCATS PROGRAM REQUIREMENTS	10/6/69	10/6/69	Change 1
II2-F	APCU PROGRAM	1/2/70		
II2-G	RSDP PROGRAM REQUIREMENTS - TM	9/23/69	9/23/69	Rev. 1, Change 2
II2-G	RSDP PROGRAM REQUIREMENTS - CMD	6/15/69	6/15/69	Rev. 1, Change 1
IIIC3-2	X-Y PLOTBOARD FORMATS	3/11/70		0 Complete
IIIC3-3	D/TV FORMATS	3/9/70		270 Complete

# MISSION READINESS

AS-508 H-2

PARA. NO.	TASK	SCHEDULE	ACTUAL	COMMENTS
IIIC3-4	PROJECTION PLOTTER FORMATS	3/11/70		4 Complete
IIIC3-6	D/TV SLIDES	3/9/70		6742 Complete
IIIC3-8	PROJECTION PLOTTER SLIDES	3/11/70		25 Complete
IIIC3-9	SHELLY DRK RETICLES	3/9/70		320 Complete
IIIC3-10	PROJECTION READOUT RETICLES	3/9/70		0 Complete
IIIC3-13	UPDATED MISSION APPENDICES	4/11/70		
IIID-3	RTCC TRAJECTORY PROG. REQUIREMENTS	10/15/69	10/15/69	Change 94
	RTCC TM PROGRAM REQUIREMENTS	12/17/69	12/17/69	Change 88
	RTCC COMMAND PROG. REQUIREMENTS			
	RTCC OPERATIONAL SUPPORT PLAN	1/30/70		
IIIF3-A	PSRD	12/3/69	12/3/69	Rev. 18
IIIF3-B	DATA RECORDING FORMATS BOOK	N/A	N/A	Not Required
IIIG-3	SIM DATA PACK - SECTION I	N/A	N/A	
	SIM DATA PACK - SECTION III	N/A	N/A	
	SIM DATA PACK - SECTION IV	10/15/69	10/15/69	
III 12	MISSION INSTRUMENTATION SUP. PLAN	1/6/70		

**ENGINEERING ORDERS**  
**AS- 508-H2**

E.O. NO.	DESCRIPTION	I AND C	TEST
3122D	INSTALL NEW MODULE - CONSOLE 73A	9/12/69	9/22/69
3297D	PROVIDE (2) CCATS RESTART CONTROL MODULES	12/29/69	
3542D	INSTALL (2) D9/5B2 MODULES - CONSOLE 37	9/16/69	10/24/69
3548D	INSTALL D9/5B2 MODULE - CONSOLE 18	9/15/69	9/19/69
4102D	REASSIGNMENT OF MOC/CIM ENCODERS	12/4/69	12/20/69
4103D	IMPLEMENT CS455 TO RTA 5 & 6	8/19/69	9/15/69
4108D	PROVIDE BCD TIME FROM MITE	12/15/69	12/19/69
4113T	PROVIDE COAX CABLE INTERFACE TO "C" CIM	12/12/69	
4115T	MODIFY SDD FOR SCU INTERFACE	12/12/69	
4116T	INTERFACE ALCIM RM 242 WITH CIM HIGH SPEED PRINTER RM 316		
4204D	MODIFY & RELOCATE CONSOLE 79	12/22/69	12/30/69
4210T	INTERCHANGE CONTROL PANEL CABLING - CONSOLE 79	12/22/69	12/30/69
4211T	SWITCH DATA THRU FM/FM & PCM SYSTEMS		
4222D	REDESIGN & REPLACE REG CIRCUIT ON 28V DC PWR SUPPLY		
4223D	RECONFIGURE CONSOLE 29		
4226D	MODIFY RESTART CONTROL MODULE CIRCUITRY		
4227D	MOVE CONSOLES 47A & 49A IN RM 112 Laterally	12/6/69	12/30/69
4229DE	INSTALL D9/2 STATUS MODULE - CSL 79 FOR CCATS TTY	12/30/69	12/30/69
4231D	REMOVE SONY TV RECEIVERS FROM 2ND & 3RD FL VIP ROOMS	12/17/69	
4611C	INSTALL HARDCOPY CAPABILITY ON RIGHT MONITOR - CSL 91		
4614C	POWER DISTRIBUTION RECONFIGURATION - CONSOLE COMM SUBSYSTEM		
4619C	INSTALL 2 DECODERS ON TRANSMIT SIDE MSFN		
4624C	MODIFY 9 RACK MOUNTED KEYSETS - FOR STOCK		
	PERMANENTLY INSTALL SINGLE LOOP JACK BOXES		

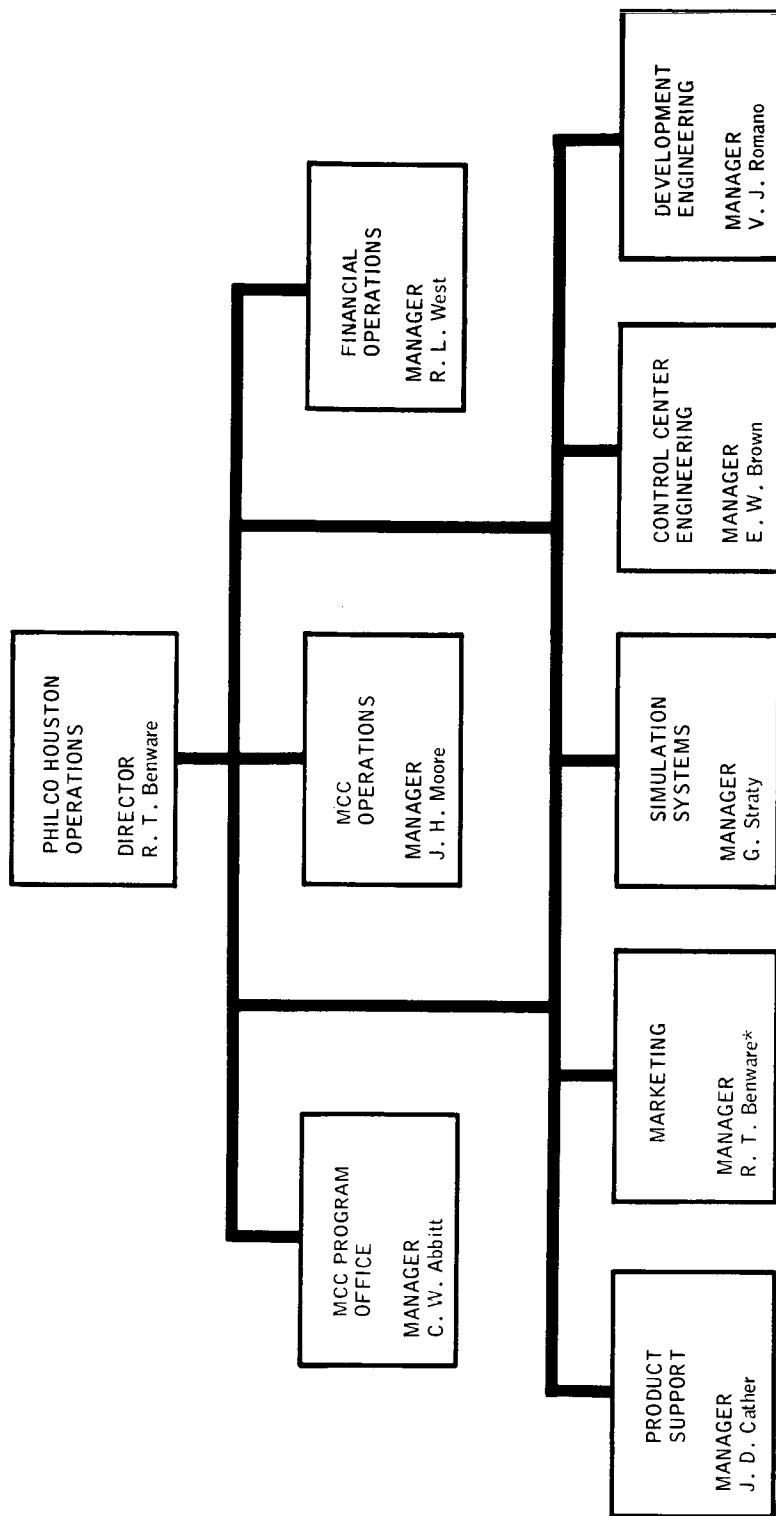
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## 1.2 ORGANIZATION

The organizational structure for Contract NAS 9-1261 remained unchanged as reflected in Figure 1-1.

ELECTRONICS GROUP



\*Acting

Figure 1-1 PHO Organization and Managerial Structure

## SECTION 2

### MISSION PREPARATION AND OPERATIONS

#### 2.1 MCC MAINTENANCE AND OPERATIONS

##### 2.1.1 Progress During Quarter

##### 2.1.1.1 MCC Reconfiguration

- A. The third-floor display system final Mission H-1 configuration totaled 669 cross-connect changes, 1379 console label changes and 352 color changes. During October, 217 cross-connect changes and 362 console label changes were implemented. There was no display system reconfiguration activity during November. The communications system Mission H-1 final configuration consisted of 2155 CCS PBI changes and 126 CCS label changes. Reconfiguration activity during the quarter included 608 CCS PBI changes and 88 CCS label changes in October and 197 CCS PBI changes in November. Installation of Mission H-1 priority modifications was accomplished in accordance with the PHO implementation schedule; all milestones were met or bettered.
- B. The display system was released from the Mission H-1 configuration on 9 December and installation of the Mission H-2 PHO-TR155 package was accomplished on 10 December. The configuration package consisted of 216 cross-connect changes and 1086 console label changes. The communications system Mission H-2 reconfiguration consists of 649 CCS PBI changes and 76 CCS label changes. Implementation of priority modifications is proceeding in accordance with the PHO schedule.
- C. ASCATS is configured in accordance with the Mission H-2 PHO-TR155 reconfiguration package. Verification was completed on 9 December.
- D. A total of 50 EO's were implemented, tested and signed off; 3350 manhours were expended in this effort.
- E. Ten EWO's were implemented, tested, and signed off; 111 man-hours were expended in this effort.

#### 2.1.1.2 Preventive Maintenance

- A. All scheduled preventive maintenance routines were satisfactorily completed, PM logs annotated, and maintenance management audits performed.
- B. Monthly test equipment calibration dates and custodial lists were prepared, distributed, and necessary calibration/repair action initiated. Test equipment is 85.1 percent in service, with 67 items out for calibration or repair during December.
- C. Seven minor industrial accidents were reported this quarter; no time was lost.
- D. Fire and safety inspections were conducted in conjunction with NASA personnel. Discrepancies noted were minor in nature, such as mission fire extinguisher locators, and have been noted and submitted to NASA for resolution by the appropriate organization.
- E. During the quarter, nine new Preventive Maintenance Instructions (PMI's) were added to the M&O Maintenance Program and 23 PMI's were revised to incorporate equipment changes and improved maintenance techniques.
- F. Four Standard Maintenance Procedures (SMP's) were revised during the quarter to reflect improved methods of maintenance and operations.

#### 2.1.1.3 Equipment Performance and Failures

- A. Equipment performance was satisfactory and proper operational support was provided for scheduled tests, checkout activities, Mission H-1, EASEP mission and ALSEP-1 mission. Details of the mission support and specific equipment outages are discussed in the *MCC Performance Evaluation Report for Apollo 12*.
- B. The D/TV converter slide file performance improvement program is continuing. Areas such as maintenance techniques, documentation, spares provisioning, and tool and test equipment adequacy are being evaluated, and improvements implemented where appropriate.

- C. M&O maintenance analysis quick look reports for September, October and November, based on trend data extracted from Trouble and Failures Reports, were distributed during the quarter. The December report was scheduled for completion 8 January. A total of 1714 Trouble and Failure Reports were prepared, analyzed, and coded.
- D. A total of 54 M&O change suggestions were submitted to PHO to improve the performance, reliability and maintainability of MCC equipment.

#### 2.1.1.4 Software Development

- A. Prepared and delivered one revised Mission H-1 PCM 102 program and three updated Mission H-1 MDD programs.
- B. Developed and delivered one new Mission H-2 PCM 102 program.
- C. Prepared seven new Mission H-2 MDD programs and five revised programs.
- D. Developed and delivered five new Mission H-2 Mode programs.

#### 2.1.1.5 Operational Readiness Tests and Plans

- A. Published Change 8 to the *MCC M&O Support Handbook*.
- B. Reviewed Missions H-1 and H-2 simulation and pad test support counts and submitted comments to the FSD Operations Section.
- C. Assisted the FSD Operations Section in preparing MCC over-all system trouble isolation flow diagrams.
- D. Published a new issue of the *Flight Support Operations Handbook*, Volume III.
- E. Published Changes 6 and 7 for the *MCC Validation Testing and Support Manual*, Volume II.
- F. Published Change 1 to the *Flight Support Operations Handbook*.

- G. Published MCC M&O Department Mission H-1 quick look report.
- H. Published *MCC Performance Evaluation Report for Apollo 12*.
- I. Conducted M&O validation testing and checkout for Mission H-1 M&O downtime day on 11 November.
- J. Configured and validated the third-floor MOCR system for Mission H-2.
- K. Conducted 11 display ORACT and 10 open loop ORACT tests for the third-floor MOCR system.
- L. Conducted 12 ALERT tests for the ALSEP system.

2.1.1.6 Operational Support Provided

- A. RTCC program development and checkout for Missions H-1, H-2, H-3, and ALSEP.
- B. CCATS telemetry, command, and DGEN program development and checkout for Missions H-1, H-2, and H-3.
- C. Missions H-1 and H-2 ORACT program checkout.
- D. GSSC and APCU program development and checkout for Missions H-1 and H-2.
- E. Mission H-1 network validation testing.
- F. Mission H-1 sims.
- G. Mission H-1 pad tests.
- H. EASEP mission support.
- I. Mission H-1 terminal count and mission activities.
- J. ALSEP-1 mission support.
- K. Mission H-2 MCC internal validation tests.

### 2.1.1.7 Training

- A. Conducted one soldering certification and nine recertification classes for M&O personnel during this quarter. Currently 126 M&O personnel are certified in accordance with the provision of HHB5300-4(3A); of these, 22 require recertification. An additional four personnel have been identified to be certified in high reliability soldering.
- B. Continued progress on the M&O certification program during this quarter. Two personnel achieved certification in their primary positions and 18 were cross-trained and certified for alternate positions. All department personnel requiring certification are now certified. The current M&O certification status is 100 percent for all subsystems.
- C. Conducted two wirewrap certification classes, resulting in eight new personnel certifications. There are presently 44 M&O personnel certified in wirewrap techniques.
- D. Sponsored and coordinated three series of classes on Building 30 MOW interfaces and data flow for Philco, IBM, Univac, and NASA personnel. Instructors were provided by each of these organizations.
- E. Conducted M&O site drills for Mission H-1.
- F. Inserted M&O simulated equipment problems during Flight Control simulations for training of M&O and other affected MCC personnel.
- G. Conducted classes on the proper completion of discrepancy reports for all M&O personnel.
- H. Eight ASCATS personnel attended classes on the ASTS Mode (EO-6157).
- I. Conducted classes on the System Configuration Unit (EO-3968).
- J. Eighteen M&O personnel attended classes on maintenance and programming for the Univac 1218 and 418 computers.

- K. Conducted television classes for eight display personnel.
- L. A class on the assembly parts listing and PHO-TR107 was conducted for M&O personnel.
- M. Eight ASCATS personnel attended a class on the Exchange Control Logic (ECL) equipment.

#### 2.1.1.8 Equipment Acceptance Tests

Engineering checkout and pre-qualification testing of the Systems Configuration Unit was supported by M&O personnel. Maintenance responsibility for the equipment was assumed by M&O on 31 December.

#### 2.1.1.9 Travel

R. Todd visited Cape Kennedy for the Mission H-1 launch. The trip was a personal performance award for achievement during the Mission G.

#### 2.1.2 Problem Areas

No major problems exist at this time.

#### 2.1.3 Plans for Next Quarter

- A. Support Mission H-2 Flight Control and Flight Support activities.
- B. Continue routine maintenance and support functions.
- C. Continue proficiency and cross-training programs.
- D. Publish Change 9 to the *MCC M&O Support Handbook*.
- E. Publish a revision to the *M&O Training Manual*.
- F. Conduct additional classes on the System Configuration Unit.



## 2.2 MAINTENANCE MANUAL REVISION

### 2.2.1 Progress During Quarter

- A. Manual Edition Order No. 4, Schedule II. This effort is 98 percent complete. The only deliverable item remaining is PHO-EM272.
- B. Manual Edition Order No. 2, Schedule III. This effort was completed with the delivery of PHO-SM104.
- C. Manual Edition Order No. 3, Schedule III. This effort is 98 percent complete. The only deliverable item remaining is PHO-EM712, which is scheduled for delivery 6 March 1970. The following deliveries were made during the quarter.
  - PHO-FAM001, final change pages
  - PHO-EM713, final manual.
- D. Manual Edition Order No. 1, Schedule III, Option 1. This effort is 70 percent complete. There are three new manuals and two change manuals remaining. The pacing manual is PHO-EM150, which is scheduled for delivery on 24 April 1970. The following deliveries were made during the quarter.
  - PHO-SM105, final change pages
  - PHO-EM258, final change pages
  - PHO-EM626, final change pages
  - PHO-EM218, final change pages
  - PHO-EM229, final change pages
  - PHO-EM255, final change pages
  - PHO-EM274, final manual
  - PHO-SM202, final change pages
  - PHO-SM102, final change pages.

E. Manual Edition Order No. 2, Schedule III, Option 1. This effort is 30 percent complete. There are three new manuals and 16 change manuals remaining. The pacing manual is PHO-EM620, which is scheduled for delivery on 26 June 1970. The following deliveries were made during the quarter.

- PHO-EM112, final change pages
- PHO-EM111, final change pages
- PHO-EM114, final change pages
- PHO-EM126, final change pages
- PHO-EM256, final change pages
- PHO-EM227, final change pages
- PHO-EM271, final change pages
- PHO-EM270, final change pages
- PHO-EM319, final change pages
- PHO-EM275, outline
- PHO-EM151, outline
- PHO-EM628, outline.

#### 2.2.2 Problem Areas

No major problems exist at this time.

#### 2.2.3 Plans for Next Quarter

Delivery of the following manuals is planned for next quarter.

- PHO-EM117, final change pages
- PHO-EM712, final manual.

## 2.3 LOGISTICS FOR MCC SYSTEMS

### 2.3.1 Progress During Quarter

- A. Completed 92 engineering orders.
- B. Updated 179 line items in the Equipment List, PHO-TR107.
- C. Completed 263 parts lists and revised 124.
- D. Researched and wrote 9803 line items for the description file and deleted 841 incorrect items.
- E. Researched and added 2345 cross references to the interchangeability file.
- F. Submitted 40,502 line items to keypunch.
- G. Reviewed and determined the repairability code for 8962 items.
- H. Submitted the October, November, and December spares status report to NASA.
- I. Submitted the October, November, and December ASPL addendum to NASA.
- J. Completed a physical inventory of Bldg. 30 substores.
- K. Submitted the semiannual ASPL to NASA.
- L. Disposed of 11,686 pounds of scrap to Ellington AFB.
- M. Transferred 34 vacuum tubes to Ellington AFB for destruction and disposal.
- N. Received disposition instructions on 17 plant clearance cases.
- O. Submitted 16 plant clearance cases to DCASO for disposition instructions.

- P. Developed and circulated 13 screening lists of surplus, excess, or obsolete material prior to plant clearance action.
- Q. Fourth quarter cycle inventories of M&O spares and EO material have been delayed by the holidays and will not be submitted until mid-January.
- R. Revised Procedure 22 in the logistics support manual to conform with the new method of reporting moves of plant equipment.
- S. Submitted results of the 1969 annual inventory of plant equipment to DCASO.
- T. Submitted the NASA Form 1018 report to DCASO.
- U. Supported Mission H-1 with 24-hour coverage and excellent results.
- V. Continued all training programs which are progressing well and achieving the desired results.
- W. Continued elimination of excess, obsolete, and surplus material from our records.
- X. Bldg. 30 replacement parts were as follows:
  - 3988 items requested by M&O technicians
  - 3957 items delivered to M&O technicians (99 percent)
  - 3645 items issued from substores stock (91 percent)
  - 343 items ordered from Logistics Distribution Center
  - 223 items issued from Logistics Distribution Center stock (65 percent)
  - 120 items back-ordered
  - 26 items remain on back-order.

### 2.3.2 Problem Areas

No major problems exist at this time.

### 2.3.3 Plans for Next Quarter

- A. Complete warehouse rearrangement.
- B. Submit the January, February, and March spares status report to NASA.
- C. Submit the February and March ASPL addendum to NASA.
- D. Submit the fourth quarter cycle inventory of M&O spares and EO material to DCASO in mid-January.
- E. Begin the first quarter 1970 cycle inventory of M&O spares and EO material.
- F. Continue our efforts to dispose of excess, surplus, and obsolete materials.
- G. Develop new 1970 training programs for all sections.
- H. Continue to parts list, spare, and add or update items in the Equipment List, PHO-TR107, as defined by engineering orders.
- I. Continue to maintain the high efficiency reached in processing repairable spares and putting them back into the logistics system.

## 2.4 MCC OPERATIONAL CONFIGURATION DOCUMENTATION (PHO-TR155) AND TESTING (ORACT)

### 2.4.1 Progress During Quarter

#### A. Operational Configuration Documentation (PHO-TR155)

##### 1. Mission H-1

- a. Issued Revision C to PHO-TR155 as a result of MRR's.
- b. Provided a supplemental CCS output to incorporate unscheduled MRR implementations.
- c. Issued final scheduled revisions to all systems data packs.

##### 2. Mission H-2

- a. Delivered PHO-TR155 masters to Data Control in support of NAS 9-1261, Section 1,C.
- b. Provided an early output of ADRK information on 6 November, then a supplemental output on 19 December to ASCATS, Simulation Programming, and the slide lab.
- c. Issued a supplemental CCS output to the Comm Section and Installation.
- d. Provided ASCATS with data pack, Revision F.
- e. Delivered data pack, Revision G, to CSB, ESB, FCOB, LSB, SLV, FDB, MOD, PCB, FSB, and OSB. Reissued CSB on 9 December.
- f. Issued data pack, Revision H, to FCOB, LSB, FDB, and FSB.
- g. Issued basic PHO-TR155 configuration documentation on contractual schedule of 21 November.

- h. Issued data pack, Revision 1, to CSB, LSB, SLV, and MSB.

3. Mission H-3

- a. Delivered data pack, Revision A, to CSB, ESB, LSB, SLV, FDB, PCB, and FSB.
  - b. Issued data pack, Revision B, to CSB, ESB, FCOB, LSB, SLV, FDB, MOD, PCB, and FSB.
4. Mission H-4. Delivered data pack baselines to CSB, ESB, FCOB, LSB, SLV, FDB, MOD, FSB, and OSB.
5. ALSEP. Provided data pack updates to reflect ESB-4 and FSB-3.

B. Configuration Testing (ORACT)

1. Mission H-2 ORACT test listings, procedures (SM001), and test package were delivered on schedule 9 to 15 December.
2. Test engineering support was provided for the following EO's: 3294, 3542, 3968 (SCU), 4102, 4201, 4203, 4205, 4213, 4225, and 4226.
3. COST II slipped to new date of 5 January. Test data to exercise program limits is being generated.
4. Revision B to the 360/75 requirements has been delivered.

2.4.2 Problem Areas

No major problems exist at this time.

2.4.3 Plans for Next Quarter

A. Operational Configuration Documentation (PHO-TR155)

1. Mission H-2

- a. Provide PHO-TR155, Revisions A and B, configuration documentation.

b. Support FCD with scheduled revisions to data packs.

2. Mission H-3

a. Issue initial PHO-TR155 output.

b. Provide data pack revisions as scheduled.

B. Configuration Testing (ORACT)

1. Provide support for acceptance of COST II.

2. Support M&O on EO testing as required.



## 2.5 QUALITY ASSURANCE AND RELIABILITY

### 2.5.1 Progress During Quarter

#### 2.5.1.1 Quality Assurance

##### A. PHO Facility Activities

1. Material Review Activities. Made disposition on 337 RMR's and 293 TFR's.
2. Receiving Inspection. Inspected 1357 line items, representing a total of 69,418 component parts.
3. Supply Requisitions. Reviewed, coded and processed 1088 SR's.
4. In-Process Inspection. Performed inspection to 49 cabinet/console assemblies, 1123 printed circuit assemblies, 126 drawer/module assemblies, 57 cable assemblies, and 168 piece parts.
5. Condition Coding. Condition coded 901 line items for plant clearance.
6. Calibration Control. Initiated request on 64 pieces of equipment and completed calibration on 39 pieces of equipment. Inspected and verified 273 special process tools.
7. Design Reviews. Participated in 3 final, 12 conceptual, and 3 interim design reviews.
8. Corrective Action Requests. Initiated 18 CAR's and took corrective action on 9 CAR's.
9. Costing Meetings. Attended two costing meetings.
10. NASA Alerts. Received 29 NASA alerts, transmitted 29, and closed 26.
11. Acceptance Tests. Performed two acceptance tests.
12. Documentation Review. Reviewed 21 specifications for final signoff.

**B. Site Activities**

1. Modification Completion and Validation Report (MCVR) Status. Completed 60 MCVR's.
2. Test Witnessing and Workmanship Inspections
  - a. Performed 74 tests with satisfactory results for the following EO's: 4603, 6180, 4203, 4213, 3730, 6204, 4629, 3031, 3112, DS002, 3294, 4201, 4205, 3273, 4902, 6156, 4106, 6161, 6173, 4003, 3505, 1865, 3125, 1441, 1738, 3171, 3553, 4208, 1558, 6012, 3102, 3123, 3287, 3709, 3122, 3056, 3730, 4019, 3294, 4201, 3542, 3537, 6206, 3635, 4215, 1877, 3053, 4022, 3182, 4627, 4630, 4620, 3121, 3731, 4626, 4639, 4015, 4020, 4225, 4640, 4114, 4023, 4228, 4025, 4642, 4024, 6205, 3544, 4108, 4102.
  - b. Made 111 in-process inspections to 61 EO/EWO's.
  - c. Made 69 final inspections to 62 EO's and accepted workmanship.
  - d. Made 16 final inspections to 16 EWO's and accepted workmanship.
  - e. Issued 14 DN's, closed 10, and 45 are outstanding.
  - f. Issued 59 RMR's, closed 67, and 11 are outstanding.
  - g. Made disposition on 982 TFR's.
3. Receiving Inspection. Performed 7 inspections with acceptance granted to 150 major line items.
4. Shipping Inspection. Performed 116 inspections with shipping authority granted to 932 line items.
5. MRB Action. Held 13 formal and 21 informal material reviews.

6. Maintenance. Inspected and accepted workmanship on 1658 maintenance work orders.
7. Reconfiguration. Performed 1302 inspections to 1302 configuration changes to the communication main distribution frame. Performed 96 inspections to 649 changes in the cable termination cabinets.
8. Tool, Gauges and Test Equipment Verification. Inspected 188 items to ascertain compliance to primary and secondary calibration standards.
9. Critical Equipment Access Control. Performed 56 inspections.
10. Personnel Certification. Certified 1 and recertified 25 M&O personnel to perform hand soldering.
11. Auditing. Surveyed 10 subsystems in accordance with the MCC quality assurance systems survey. Performed one audit of the Logistics stores area within the MCC facility.

C. Special Activities

1. Completed MCC system survey for submission to NASA on 30 October.
2. Considerable research on NASA library on adhesives and metal-to-metal bonding and plastics bonding revealed a NASA-prepared specification on this. A report will be written at the conclusion of the testing being conducted.
3. Another trip was made to Hazeltine on PCB problems. Samples are being sent to PHO for consideration of their repair techniques.
4. The TFR form has undergone another major revision, adding provisions for keycard number 2 to accommodate reliability and speed up the keypunch operation.

5. Provided mission support for Mission H-1.
6. Reviewed IS4000-00051E and submitted comments.
7. Conducted a review of NASA soldering requirements for Manufacturing lead technicians.
8. Participated in plated slide blade evaluation meeting.
9. Spent considerable time with two representatives from Stromberg-Datagraphix on charactron tube problems. Results of the investigation were not completely conclusive.
10. Investigated material (paper) for use on painted surfaces for protection during handling in assembly.
11. Participated in preliminary review of EO-4625, which attempted to permanently install a portable tape recorder in a modem cabinet. NASA Engineering and NASA QA will resolve contractual differences as to the requirements for a letter of exception.
12. Attended final design review at Hazeltine on the DTE equipment. A trip report will be prepared detailing what was accomplished and the specific areas that were outstanding.
13. Prepared Mission H-1 post-mission report.
14. Began configuration index in response to second floor deactivation implementation instruction.
15. Participated in the establishment of a 4D Micrologic Module repair facility preliminary operations procedure.

## 2.5.1.2 Reliability Engineering

### A. EO/TO Support

1. Support Completed. Reliability/maintainability analysis, prediction, and documentation in support of engineering orders were completed as follows:

<u>EO No.</u>	<u>Documentation</u>
3297, CCATS Computer Restart Control Module	PHO-TN301
3968, SCU	PHO-TN307
4104, Modifications to DDD/SDD	PHO-TN300 and CS608
4207, Console 79 Power Supplies	Letter to W. B. Harrell from M. Grayson, dated 6 October 1969
3530, Single Meter Control Indicator Modules	PHO-TN303
4108, MITE Modifications	PHO-TN306 and CS607
4211, Modification to 28 V dc Power Supply Regulator Circuits	PHO-TN305

2. Support In Progress. Reliability engineering support for engineering orders is continuing as follows:
  - a. EO-4903. Reliability analysis of changes and additions to the high speed printer equipment has been completed. Documentation of the results is in progress.
  - b. EO-1883. Reliability analysis of the proposed Building 30 power monitor and control system has been initiated.

B. Special Projects

1. Failure analysis of a Gast air compressor from the PDU subsystem was completed and documented as PHO-TN302.
2. An analysis summarizing the available facts concerning the effects of seal coating on the reliability of SCU type PCB's was completed and documented as PHO-TN304.
3. Stress analysis on the console monitor modification proposed by CS602 is in progress. The purpose of the study is to check for potential reliability problems.
4. Failure analysis of the DDD logic card connector blocks in in progress.
5. Training sessions on "reliability modeling and exercises" and "solving for closed form expression as a function of time" were held on a regularly scheduled basis.
6. Development of the PERP system continues (equipment reliability/maintainability performance summary). The original main control and input editor programs have been checked out and are running. Modifications are being incorporated to reduce running time and to account for the new TFR form. The report generators have been undergoing test and debugging. The major portions of the report generators have worked successfully with test data. An estimated 90 percent of the test and debug of these programs is complete, and preliminary documentation of the system is complete.
7. The PERP master reference file has been completed as follows: (1) model number, serial number, nomenclature, and mode of time reference for 90 percent of the subsystem components, and (2) reliability prediction data for 13 subsystem components. The configuration portion of the QA and chassis files is approximately 70 percent complete. Delay is being experienced in completing the configuration portions of the files due to unresolved discrepancies in equipment identification.

8. Coordinated effort with logistics, engineering support, and M&O to reconcile discrepancies in equipment tags based on the output from the physical inventory. Approximately 80 percent of the CODI S/S equipment tag discrepancies have been resolved. Approximately 40 percent of this task exclusive of replacing equipment tags has been completed.
9. Revisions to the reliability section of the TFR form were completed. Revision to the associated TFR implementation procedure was completed and incorporated within a QCI.
10. Reevaluation of the VSM reliability predictions and generation of the PERP reference file input cards has been completed. Approximately 60 percent of this task has been completed for the D/TV buffer.
11. Approximately 2000 failure records were processed to provide the equipment performance reports for the months of September, October and November. The November report was processed by PERP with performance being based on the failure data collected on the new TFR form since 15 July. Baseline predicted data is provided within PERP for those 13 S/S components on which predictions have been reevaluated. This baseline data will be augmented under the baseline data task.
12. A modification to the 1130 matrix reduction program was completed to provide for processing a system state reliability array up to size 99 x 99.

#### 2.5.1.3 Travel

- A. Quality Assurance personnel made 16 local and one distant trip. Mr. G. Miller from Philco's West Coast Operation traveled to PHO on two occasions for the purpose of check-out and testing of PERP routines. Mr. J. Legg, also from the West Coast, accompanied Mr. Miller on one trip.
- B. Mr. A. Croft attended the Reliability Engineering and Management Institute held in Tuscon, Arizona, from 3 October to 10 October.

- C. Mr. M. Fowler attended the meeting on Plastic Encapsulated Semiconductors held in Washington, D.C., on 18 November.

### 2.5.2 Problem Areas

No major problems exist at this time.

### 2.5.3 Plans for Next Quarter

#### 2.5.3.1 Quality Assurance

- A. Initiate a Standards Repair Manual.
- B. Furnish a process specification for wave soldering.
- C. Approve Revision E of IS4000-00051 specification.
- D. Publish findings of adhesive bondings research.
- E. Complete configuration index detailed for second floor deactivation.
- F. Complete the 4D micrologic repair facility workmanship standard by abstracting NHB 5300.4 (3A) as amended by contract.

#### 2.5.3.2 Reliability Engineering

- A. Complete effort on EO's 4903 and 1883.
- B. Process TFR's.
- C. Complete modifications and checkout of PERP.
- D. Commence concentrated baseline prediction and analysis efforts.
- E. Perform failure investigations upon request and as indicated by the PERP outputs. More efficient performance of component analyses will result in the future upon obtainment of the recently negotiated test equipment for the reliability lab.



## 2.6 INSTALLATION OF MCC SYSTEMS MODIFICATIONS AND RELATED INSTALLATION TASKS

### 2.6.1 Progress During Quarter

#### A. Design

1. Completed and released 73 installation design packages for installation tasks on 48 EO/EWO's.
2. Forwarded final installation design documentation to Drafting, Data Control, and/or Configuration Control for 67 EO/EWO's.
3. Generated and released six reconfiguration cross-connect listings for Missions H-1 and H-2.
4. Released information for revising and updating 93 master cable and CTC cross-connect termination lists.
5. Forwarded monthly inputs to Configuration Control to update tab runs for PHO-TN121 through PHO-TN125.
6. Received 47 new EO's for installation. Installation cost estimates were prepared for 51 EO/EWO's.
7. Generated and released EI's and task statements for five EO's.
8. Completed updating of data flow charts for PHO-TR333.

#### B. Implementation

1. Completed installation tasks for 52 EO/EWO's.
2. Partially completed installation tasks on 28 additional changes.

### 2.6.2 Problem Areas

No major problems exist at this time.

### 2.6.3 Plans for Next Quarter

Continue implementation of approved EO's as equipment deliveries and operational committments allow.

## SECTION 3

### ENGINEERING

#### 3.1 MCC SUPPORT

##### 3.1.1 General TO-820, FSD General Task

###### A. Document Management

1. TO-820 Documents Update. The efforts performed to accomplish this task are outlined as follows:
  - Number of EO's reviewed and reported in EO/EWO Status Report - 291
  - EO manual update requirements reported - 79
  - Number of EO's cleared of manual requirements - 112
  - Number of EO's reported, Categories L and R - 120
  - Number of EO's (effects of) incorporated in final manual deliveries - 76
  - Number of vendor manuals reviewed - None
2. TO-820 Document Deliveries. Deliveries during the quarter were EM260, final change pages.

- ###### B. CML Control and Status. Thirty-two out-of-scope material requests (PHO Form 4730) were submitted during this period. The CML Status Reports (40 copies) on Schedule III, Option 1 EO material list authorization were distributed on 15 October, 13 November and 11 December.

###### C. CAD System Analyst

1. Prepared the monthly Computer Usage Reports and Computer Status Reports and delivered them to NASA.

2. Provided consultation to PHO programmers regarding CAD software systems.
3. Wrote a report and developed an information form for NASA on what has to be known to convert a computer programming system from one computer to another, using a high-level language.
4. Provided programming assistance to the logistics, CML, and DRIP/DRAP projects.
5. Filled out an information form on the UNIVAC 1106/7/8 for NASA.
6. Coordinated the NASA questionnaires on the PHO programming projects for conversion to a different computer.
7. Researched the availability and cost of the software for a Cal Comp Plotter on the UNIVAC 494 for the BURP project.

D. Wire Listing Program Maintenance and Coding

1. Wrote program to reformat DW-09113 cards for input to wirelist program.
2. Completed coding on DW-14155 original, DW-14373 original, and DW-09113 original.
3. Completed FSD Computer Program Questionnaire.

3.1.2 Specific TO's

None.

3.1.3 Engineering Orders

- A. EO-1870. Category D, awaiting completion of the MCVR.
- B. EO-1871. Category 4, scheduled ship date of the mod kit to the site is 30 January. Implementation will be in February, dependent on area access.

- C. EO-1872. Category 4, scheduled receipt of parts at PHO is 14 January. Implementation will be NIB.
- D. EO-1874. The final part (Amendment No. 1) of this EO was implemented on 2 December 1969. The entire EO is now ready for test.
- E. EO-1876. The procurement of material is awaiting 4730 approval.
- F. EO-1877. Category 8.
- G. EO-1880. Implementation was completed on 2 December 1969. The EO is now ready for test.
- H. EO-1881. EI No. 1 was released on 22 December 1969. This EO is for design, costing and scheduling only.
- I. EO-1883. EI No. 1 was released on 4 December 1969. This EO is for design, costing and scheduling only.
- J. EO-1884. Category D - awaiting completion of the MCVR.
- K. EO-3101. Category D - awaiting completion of the MCVR.

## 3.2 SYSTEM ENGINEERING

### 3.2.1 General TO-3000, Display Engineering

A. General. Continuous on-site engineering support was provided during Mission H-1 to provide assistance in resolving system and equipment malfunctions and to insure rapid restoration of critical equipment. Noteworthy problems which occurred during the mission were evaluated to determine whether modifications were required.

B. Specific TO's

1. TO-3001, Plotboard Vacuum Pump Study. An alternate motor was installed and evaluated but was excessively noisy. This study is continuing.
2. TO-3003, Projection Television Ozone Exhaust Study. An ROM cost meeting was held on 22 December. Final costing information for the recommended correction will be submitted in January.
3. TO-3004, Plotting Display Equipment Improvement Study. This study is currently in progress but has been delayed due to higher priority EO's and a lack of available manpower.
4. TO-3005, Color Converter Investigation. This study was received on 10 December and authorized the preparation of a specification for a sequential to NTSC color converter.  
  
Preliminary vendor responses were solicited and received by 19 December. A preliminary specification will be submitted to NASA for review on 5 January.
5. TO-3008, MPAD Display System Study. A preliminary ROM cost estimate and technical proposal was submitted to NASA on 15 December. A final report will be submitted after review of the preliminary by NASA.

C. Specific EO's

1. EO-4002, Relocation of Building 45 Video Equipment. This EO was installed on 13 October, tested on 24 October, and is now complete.
2. EO-4015, Building 45 Time Display. This EO was completed and tested prior to mission support. Final documentation was completed in December.
3. EO-4016, Hot Cassette Modification Kit. EI No. 1 was released on 4 November to purchase the kit. Installation was completed on 29 December.
4. EO-4019, Hardwire for Four ADEG Monitors. This EO was completed and tested prior to mission support. Final documentation is in progress.
5. EO-4020, Installation of Overhead Monitor. This EO was completed and tested prior to mission support. Final documentation is in progress.
6. EO-4022, Installation of MOCR Color Camera and Video Link to Building 1. Installation and testing of the GFE color camera was completed on 11 November. EI No. 2, which provides for installation of new video cables and terminal equipment between Building 30 and Building 1, was released on 26 November. This portion was subsequently cancelled by NASA. Costs for work done are being collected.
7. EO-4023, Installation of Additional TV Receivers. This EO was installed and tested on 12 November. Final documentation is in progress.
8. EO-4024, Additional TV RF Feeds. This EO was installed and tested on 14 November. Final documentation is in progress.
9. EO-4025, Video Feed. This EO was installed and tested on 12 November for temporary mission support, and is now awaiting removal.

10. EO-3110, Modification to GFE Typewriter/Camera Console. This EO was installed and tested and is awaiting final documentation. This equipment was relocated and modified under EO-4215.
11. EO-3111, Modification to Color TV System. EI No. 9 was released on 14 November to authorize implementation of previous EI's. EI No. 10 will be released to complete final tasks under this EO.
  - The horizontal and vertical blanking circuit has been completely redesigned. All circuit changes completed in the past year were documented on marked-up schematics and photographic negatives. Prints of these changes were submitted to the patent section in the form of four separate patent disclosures. This was also released to the Technology Utilization Office of NASA.
  - A switch was added to the horizontal output stage to shift feedback capacitance when transferring line rates. A special high voltage mounting for this switch was designed, fabricated and installed.
  - A search was made for the proper light filters for use in black/white operation to remove the yellow from the white light. These filters are on order and a special holder will be designed and fabricated for them.
  - The 300-volt power supply was restored to its original condition by replacement of various off-value resistors. The proper value plate suppressor resistors were installed on mountings fabricated in the SEF to eliminate the intermittent oscillations.
  - Layout design on a new convergence panel is about 90 percent complete. Most of the material for this panel is on hand in the SEF.



- Installation of changes in the projector required by the status alarm panel from EO-3058 has been made. A horizontal focus and intercom amplifier sub-chassis was installed on the projector.
  - A 1-week training period was conducted to acquaint the Eidophor operators with the complete operating and set-up procedure. A set of operator qualification requirements was drawn up and submitted to M&O on their request. The projector operated during Apollo 12 with no failures of any kind.
12. EO-3112, Removal of Reference Slide Files. This EO was completed and tested in October. Final documentation is in progress.
13. EO-3120, Alphanumeric Display Unit. EI No. 2, which defined Manufacturing's task was released on 12 December. Wire lists for 45 of a total of 47 PC boards have been completed and released to Manufacturing. PBC assembly was to begin on 29 December and is scheduled for completion on 29 January. Fabrication of all mechanical hardware is in progress. Wire lists for the control panel and power panel are complete and cabinet wire lists are in progress. Demonstration of the functional capability of the prototype unit is scheduled to take place in February.

### 3.2.2 General TO-3100, Timing and Control Engineering

#### A. Specific TO's

1. TO-2206, Universal 18 PBI Module. Received 5 August; completed 11 December 1969.
2. TO-2217, Readout Evaluation Study. Last of required parts received 15 September. Report is in engineering review.
3. TO-3102, Study of High Cost of CIM Documentation Revisions. PMO release date was 8 July 1969. Received on 16 July; requested extension to 15 October on 18 September. Draft completed 20 October.

**B. Specific EO's**

1. EO-3121, Installation of Stopclock on Console 88, and One for Engineering Spares. The EO was received 4 June 1969; Amendment 1 was received 3 July. EI No. 1 was released on 5 July. EI No. 2 was released 23 July; EI No. 3 was released 22 August. RT on operational stopclock complete 31 October. Spare stopclock tested 12 December. Engineering complete.
2. EO-4101, Command Capability for Console 4, Both Floors. EO received 8 July 1969. EI No. 2 was released 18 August. Operational need date 1 September for Mission H-3. Third-floor installation completed 20 August. Third-floor testing completed 5 September. Second-floor installation depends on EO-4201, scheduled for February, 1970.
3. EO-4102, Reassignment of MOC-CIM Encoders and Removal of Isolation Modules in Item 85. EO received 8 July 1969, NASA need date was 1 September. EI release date, 21 August. Second-floor installed 15 September. Third-floor installed 10 December. Final test completed 17 December.
4. EO-4104, Reconfiguration of DDD/SDD Power. EO was received 3 July. EI No. 1 was released 25 August. EI No. 2 released on 20 October. Engineering correction of documentation in process. Awaiting an amendment referenced to CS 603.
5. EO-4108, BCD Time from MITE to SCUHSP. EI No. 1 released on 2 September with assembly to be complete by 26 November. Testing was to be concurrent with installation. EI No. 2 released 25 November; RT completed 17 December. Minor installation rework in process.
6. EO-4109, Reconfiguration of Room 214 and Consoles 81 and 82, Room 212. EI received date was 1 September; EI released 5 September. This EO was cancelled and replaced with EO-4225 on 14 October.

7. EO-4113, Change to CCIM-SCU Cable Interface.  
Operational need date was 15 December with B2 priority. EO received on 29 October. EI No. 1 released 26 November. Installation complete 9 December. Pre-AT run on 14 December. Final acceptance contingent upon EO-3968 completion.
8. EO-4115, Changes to CCATS SDD-SCU Cable Interface.  
EI No. 1 released 1 December. Installation complete 9 December. Pre-AT run 14 December. Final acceptance contingent upon EO-3968 completion.
9. EO-4116, Addition of ALCIM to HSP Interface. EO received 21 November. It has a B2 priority. Task statement is due 15 January. EI No. 1 in process.

3.2.3 General TO-3200 Telemetry Engineering

A. Specific TO's

1. TO-2304, Event Recorder Paper Capacity Problem Study.  
Awaiting proposal from vendor to complete task. Both PMO and Procurement have taken action to solicit this proposal from vendor. Vendor efforts in process.
2. TO-3210, Console Power Supply Documentation Study.  
TO completed 1 December 1969.

B. Specific EO's

1. EO-4201, Modification to Consoles 2, 4, 20, 23, 24, and 31. EO received 8 July. Operational need date was Mission H-1. Third-floor Consoles 4 and 24 installation complete. The TTY move and recorder has been installed. Third-floor CCATS final test was completed 17 September. Third-floor RTCC final test was completed 8 October. Per NASA EAN of 22 September, the D9/SUB2 design is in fabrication.

8. EO-4213, Installation of Indicator Module on Console 11, Both Floors. Final RT scheduled for 14 October 1969 and completed on this date.
9. EO-4215, Relocation of LGE Console and Video to Room 210. This had an operational need date of 23 October 1969 and a Z1 priority. EO received 7 October 1969. EI No. 1 released 15 October 1969. RT completed 28 October 1969.
10. EO-4219, Modification of the PCMGS to Accept New Six-Bit Sync Words. EO received 17 September 1969. EI No. 1 released 8 October 1969. Installation completed 3 October 1969. Testing completed 29 October 1969.
11. EO-4222, Reconfiguration of Console 29. This had an operational need date of 29 December 1969 and a B2 priority. EO received 21 October 1969. EI No. 1 released 4 November 1969. Installation depends upon completion of communications EO-4635.
12. EO-4223, Modification to the Restart Control Module. This had an operational need date of 29 December 1969, and a B1 priority. EO received 22 October 1969. Modification in process.
13. EO-4225, Provision of FSMR and Move of Tech Ops Room 212. This has a Z1 priority. EO received 14 October 1969. RT completed 7 November 1969.
14. EO-4226, Move of Consoles 47A and 49A. This has a B2 priority. Cost package was due NASA 2 January 1970. Consoles are modified and ready for test.
15. EO-4227, Installation of a D9/2C Status Module in Console 79. This has a B1 priority and an operational need date of 24 December 1969. Warehouse AT on D9/2C completed 19 December 1969.

2. EO-4203, Removal of Four Modules in Console 86, Installation of MSK in Console 86, and Renumbering of Console 86. EO received 8 July 1969. Final test completed 14 October 1969.
3. EO-4204, Relocation and Reconfiguration of Console 79. A and B systems final tested 30 August 1969. C system installation scheduled after Mission H-1. Mission priority changed to B1 21 October 1969. Received Amendment No. 2 21 October 1969. EI No. 4 released 4 November 1969. C system modules tested and shipped to site 10 December 1969.
4. EO-4205, Reconfiguration of Consoles 8, 9, 31, and 32, Third-Floor Only. This EO was received 8 July 1969. EI No. 1 released 1 August 1969. EO in hold per EAN 18 August 1969. CSL 9 released from hold per Rev. 1, 26 August 1969. EI No. 2 released 5 September 1969. CSL 9 reconfigured on 10 September 1969. Open loop testing completed on 19 September 1969. D.C. time to complete final test was available and accomplished on 7 October 1969.
5. EO-4207, Redundant Power Supplies for Console 79. Received 5 August 1969. Operational need date 1 September 1969. EI No. 2 was released 6 November 1969. Power supplies reworked in Manufacturing, tested, delivered, and installed in the console 26 August 1969. Testing completed 20 August 1969. EO reopened on 9 October 1969 to increase maintainability.
6. EO-4210, Routing of Data Intended for the FM/FM System Thru the PCM System. EO received 8 September 1969. EI No. 2 released 24 November 1969. Installation was scheduled for 24 December 1969.
7. EO-4211, Replacement of Regulator Circuits on Console Power Supplies. EI No. 1 released 16 October 1969. EO placed in "cost but do not implement" hold. EI No. 2 released 16 November 1969. This EI is intended to replace EI No. 1 and reduce Manufacturing costs.

### 3.2.4 General TO-3400, Digital Television Engineering

A. General. Engineering support of Mission H-1 resulted in a schedule slippage of some tasks in progress due to the reduced manpower allocation.

B. Specific TO's

1. TO-2402, Alphanumeric Display Cluster Design. Logic and mechanical design is 95 percent complete. Wire listing is currently 95 percent complete. Fabrication efforts will be completed under EO-3120.

C. Specific EO's

1. EO-3401, DTE Procurement. The DTE eight-channel cluster and the associated master sync and timing unit (MSTU) are presently 90 percent fabricated with all cabinets in the testing phase. An expected ship date from Hazeltine Corp. of 27 March 1970 represents a 9-week schedule slip from the contractual 23 January 1970 date. The slippage is mostly due to a measling and lifted land problems in the printed circuit board manufacturing process at Hazeltine. The problem is now corrected and replacement boards are being manufactured. A final design review was conducted at Hazeltine Corp. on 17 and 18 December to discuss the following items:

- DTE Implementation Plan, PHO-TN406
- DTE Acceptance Test Procedure, SE-09253
- DTE Qualification Test Procedure
- DTE Qualification Test Program Requirements, PHO-TN390A
- M&O Training
- Future Cluster Options
- Tour through Test Area

2. EO-3402, Video Switch Matrix Buffer Multiplexer.  
The VSMBM was shipped and installed on 23 October. Installation testing was completed on 5 December. Final acceptance testing cannot be completed until after installation of the first DTE cluster.

### 3.2.5 General TO-3600, Communications Engineering

#### A. Specific TO's

1. TO-3600, Modification to FACS/ASCATS Interface. Preliminary investigations were completed in October, awaiting further TO information from NASA.
2. TO-3600, Memory/Printer Systems. A presentation was made to NASA Engineering. NASA has suspended EO action until later date.
3. TO-3600, WBD Recording Modification. No additional work has been accomplished, and NASA has indicated that an EO will be forthcoming.
4. TO-3601, Noise Study in CCS. This TO was received and tests conducted during last quarter. In this quarter, a report was submitted on 14 November listing causes of noise and recommending further study to achieve an optimum solution.

#### B. Specific EO's

1. EO-4605, New CCATS PA Zone. Two power amplifiers were to have been procured under EI No. 1, however, documentation problems prevented the SR from being issued until late December.
2. EO-4611, CCS Power Regrade. Implementation is progressing smoothly. New 48-volt meter and shunt panels have been installed, along with necessary power bay rework. New distribution cables for 24-volt and 48-volt systems are in, and the cut-over to equipment racks has begun. Plans now call for all third-floor and common area racks to be on new system prior to end of January, with second floor cut-over at a later date.

3. EO-4614, Decoders for MSFN Transmit Lines. All EI's have been released. Awaiting procurement action and implementation schedule. Installation postponement was requested by NASA until January 1970 to minimize problems with SCU EO-3968 installation.
4. EO-4616, Relocation of VIP Room Consoles. This EO requested action prior to Mission H-1, but a display EO required to remove console TV Monitors was not received in time to implement as requested. Higher priority jobs have caused this job to slip until after 1 January 1970.
5. EO-4617, Flight Support Management Room. This EO was implemented and tested on schedule.
6. EO-4618, Audio to TV Modulators. This EO was implemented and tested on schedule.
7. EO-4624, Permanent Maintenance Loop Jackboxes. This EO will replace a temporary installation put in under EO-3156. Required EI has been released and installation is awaiting shipment of materials.
8. EO-4625, Relocation of Bio-Recorder from Room 129 to Room 118. EI's were released and the installation in Room 118 is complete, awaiting final inspection and testing.
9. EO-4629, Flagstaff Radio Circuit. This EO calls for the installation of keying facilities on certain circuits. They are to be installed before cinder-field simulations prior to Missions H-2 and H-3, and removed after the simulations but before the missions proper. Installation before, and removal after, the cinder field simulation for Mission H-2 has been accomplished.
10. EO-4631, FACS/SCU Interface Implementation. EI's released and implementation is on schedule per EO-3968 implementation schedule. Amendment No. 1 (EI No. 4) has been installed, extending low-speed System C CLT's for switching compatibility with Systems A and B.



11. EO-4632, A/G Muting During EVA. This EO was received, implemented, and tested prior to Mission H-2.
12. EO-4636, Modification of A/G Cabinet and Addition of Eight Circuits to CLS. This EO has been implemented and tested; however, release of TPS is being held pending resolution of variance between documentation and as-built conditions. This will be corrected in early January and the TPS released then.



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### 3.2.6 TO-3900, Data Format Control Book

#### 3.2.6.1 Progress During Quarter

##### A. Telemetry Data Format Control Book (TDFCB)

1. Mission H-2 TDFCB, Rev. 2. This was due 22 October and delivered 15 October. Included were:
  - Master and two copies
  - Tapes and discrepancies
  - CCATS decom update cards and three listings
  - HS & WB requirements
  - Index listing
  - FC listing
2. Mission H-1 TDFCB, Rev. 4. This was due 15 October. A master and one copy and the HS and WB requirements were delivered on that date.
3. Mission H-2, Rev. 2, and Mission H-1, Rev. 4, TDFCB's were delivered 22 October including a CCATS/KSC compare and an air-to-ground compare.
4. ALSEP IV TDFCB Rev. 1. Due 24 October; master delivered on that date.
5. Checked MCC Master Measurement List; delivered 23 October.
6. Checked PHO-TR155 against Mission H-1 TDFCB, PCM Ground Station Rev. 3. Delivered 7 October.
7. Updated HS Format 30 CCATS decom cards for Mission H-2 TDFCB, Rev. 1 and delivered 30 September.
8. Format print tape specifications and Mission H-1 TDFCB, Rev. 3 format print tape copy delivered 2 October.

9. DECOM REV modification and checkout completed for removal of measurement number compare on RTCC and PCM G.S. cards.
10. FMT REV modification and checkout completed to correct error in flagging changes.
11. MD 90 and DECOM modification and checkout completed for "X" in Column 50 of PCM G.S. decom cards.
12. New library designed to run on modified System 1108 completed and checkout is underway.
13. Mission H-2 TDFCB Original, due 15 December, delivered 4 December, including:
  - Master
  - Tape copies
  - Tape discrepancy letter
  - HS and WB requirements
  - RTCC card deck and two listings
  - Index listing
  - FC listing
  - FC compare
  - Master tape compare
14. Mission H-2 TDFCB, Rev. 3, due 22 December, delivered 17 December, including:
  - Master and two copies
  - HS and WB Requirements
  - Index listing
  - FC listing

- Tape copies
  - Tape discrepancy letter
  - CCATS decom update cards and two listings
  - RTCC update cards and two listings
15. Prepared solution to checkout problem of CCATS/KSC decom on 4 December.
  16. Prepared implications of Colossus 2E downlink changes on Mission H-3 TDFCB and delivered RTCC update cards on 5 December.
  17. Checked PHO-TR155 against Mission H-2 TDFCB Rev. 2 PCM G.S. on 9 December.
  18. Prepared implications of Luminary 1D downlink changes on Mission H-3 TDFCB and delivered RTCC update cards 16 December.
  19. Prepared and delivered RTCC update card for Mission H-3 to add K0200-404 requirements on 16 December.
  20. Delivered a master compare between Mission H-1, Rev. 4 and Mission H-2, Rev. 2 for DGEN on 18 December.
  21. Delivered a KSC Compare between Mission H-1 Rev. 3 and Mission H-2, Rev. 3 for DGEN on 18 December.
  22. Prepared and delivered the FSD computer program questionnaires for ACTEF on 19 December.
  23. Prepared and delivered a new Mission H-3 master tape, discrepancies and summary for ALDS on 23 December.
  24. Prepared and delivered a new Mission H-3 master tape for GSFC on 24 December.

B. Command Data Format Control Book (CDFCB)

1. CDFCB Rev. 4, Change 4. This was due 9 October; a master and four copies were delivered on that date. (Rev. 5 was not released.)
2. ALSEP CDFCB, Rev. 2, Change 2. This was due 13 October; a master and four copies were delivered 8 October.
3. Preliminary CDFCB, Rev. 5 (Reissue) was delivered on 17 December for review.
4. Flip charts were delivered on 19 December for CDFCB presentation.
5. RTC list program was modified and is being checked out.

C. Tracking Data Format Control Book (TRK DFCB). Delivered preliminary TRK DFCB, Rev. 5 for review on 29 December.

3.2.6.2 Problem Areas

No major problems exist at this time.

3.2.6.3 Plans for Next Quarter

A. TDFCB

1. Prepare and deliver revisions as required to the Mission H-2 and H-3 TDFCB's.
2. Programming is in progress for program to combine XPAND-720, IU/S4B, duplicate channel, A/G generations and format, RTCC and G.S. double defines.
3. CCATS REV modification to correct error in carrying forth revision information has not been checked out.
4. Study feasibility of outputting formats by frame rather than word, and SLV A/G channel list by word and frame rather than channel code.

5. Rewrite A/G and CCATS/SUM in order to reduce running time and increase reliability.
6. Continue study of bio-Med formats.
7. Continue study of AAP telemetry downlink formats.
8. Prepare AAP A/G downlink lists and fact sheets.

B. CDFCB

1. Continue work on study to determine feasibility of new RTC handling technique.
2. Prepare and deliver revisions and changes as required to the CDFCB and ALSEP CDFCB.
3. Maintain up-to-date Master Command Program, documentation and specifications.
4. Prepare and deliver Master Command Program tapes as required.
5. Maintain TTY Test Data Program and documentation.
6. Prepare and deliver TTY test data as required.

- C. TRK DFCB. Prepare and deliver revisions to the TRK DFCB as required.

3.2.7 TO-3925, RSDP Programming Requirements

3.2.7.1 Progress During Quarter

- A. Coordinated and wrote four Program Change Requests (PCR's).
- B. Wrote and published the following documentation.
  - Mission H-2 command and telemetry test procedures
  - DAP, Annex E, Vol. 1, Rev. 1, Ch. 6

- DAP, Annex E, Vol. 1, Rev. 1, App. 508, Ch. 2
- DAP, Annex E, Vol. 1, Rev. 1, App. 509, Ch. 1
- DAP, Annex E, Vol. 2, Rev. 1, App. 509, Ch. 1

C. Supported AS-507 Telemetry COST demonstration on 20 October, and ALSEP System integration test on 29 October.

D. Unit Personnel attended required FCD and FSD meetings to discuss RSDP program requirements and problem areas.

#### 3.2.7.2 Travel

- A. John Poffinbarger and Wayne Jolley went to GSFC 29 September to 3 October to check out the Mission H-2 RSDP ALSEP program.
- B. Tom Hiser went to Corpus Christi 20 and 21 October to test the CTE/MET history and the downlink time search requirements in the Mission H-1 RSDP telemetry program.
- C. John Poffinbarger went to MILA 29-31 October to participate in the Mission H-2 ALSEP System integration test.
- D. Tom Hiser and Wayne Jolley went to Los Angeles 2-8 November to attend a Bell & Howell measurement instrumentation training course.
- E. Tom Hiser and Wayne Jolley went to MILA 14-19 December to check out the Mission H-2 RSDP telemetry program.
- F. John Poffinbarger traveled to GSFC 14-18 December to check out the Mission H-2 RSDP telemetry program.

#### 3.2.7.3 Problem Areas

No major problems exist at this time.

#### 3.2.7.4 Plans for Next Quarter

- A. Provide checkout support for Missions H-2, H-3, and ALSEP RSDP programs.

- B. Develop test procedures for Mission H-3 ALSEP, command, and telemetry RSDP programs.
- C. Develop and coordinate RSDP program requirements for the following Missions: H-2, H-3, ALSEP and AAP.
- D. Initiate changes to DAP, Annex E and Annex E-1, as required.
- E. Attend required FCD and FSD meetings to discuss RSDP program requirements and problem areas.

### 3.2.8 TO-3950, CCATS Software Support

#### 3.2.8.1 Progress During Quarter

##### A. Program Development

1. Additional effort was spent on defining the software interface requirements for the proposed CCATS Alphanumeric Display System. A meeting with NASA resulted in a temporary deferment on this task pending evaluation of the DTE and prototype alphanumeric display equipment. Once the outcome of the two display system evaluations is disclosed, NASA will provide appropriate redirection on this task.
2. Developed and delivered a draft copy of RESTART requirements to NASA for review. Incorporated NASA's comments into RESTART and submitted them to the CCATS Program Requirements Documentation Unit for publication in the forthcoming Version IV change.
3. Commenced research into the proposed Digitized Biomedical Data Handling System to develop CCATS program requirements.

##### B. Program Requirements Documentation

1. Program Configuration Requirements, Mission H-2. Change 1 to this document delivered to users on 22 October. The masters for Change 2 were delivered to NASA on 23 December.



2. GSFC/MSC Communications Program Interface Control Document (CPIC). Change 2 to this document delivered to users 24 October.
3. Program Requirements, Version IV. Masters for Change 3 were delivered on NASA on 8 December.
4. Program Configuration Requirements Document. A CCATS Computer and Utilization Accounting System (CCUAS) program was utilized to construct a data tape for a demonstrative run of Mission H-2 configuration requirements via the CCUAS TEXT WRITER. A document update was also demonstrated utilizing the program. The text data tape and Mission H-2 demonstrative document printouts were delivered to the customer on 24 November.

#### C. Maintenance and Operations

1. Computer Utilization Account System (CCUAS). Development of the CCUAS was completed during this reporting period. The CCUAS was delivered to NASA on 19 November.
2. Eight-Month Usage Projection Reports. The Eight-Month Projection Reports were compiled and delivered to NASA as per schedule.
3. Scheduling Support. Provided assistance in preparing the priority testing summary sheets for the weekly FOSO scheduling meetings. Maintained records pertaining to the scheduling support.
4. CCATS/SCU Standard Operational Configuration Criteria. Delivered draft copy of the CCATS/SCU Standard Operational Configuration Criteria document to NASA 12 December.
5. Mission Support Personnel Certification Criteria. Delivered an updated version of the CCATS Mission Support Personnel Certification Criteria document to NASA for review and comments on 13 October.

6. CCATS/SCU Operational Confidence Testing Specification.  
Delivered draft copy of the CCATS/SCU Operational Confidence Testing Specification to NASA 12 December.

### 3.2.8.2 Problem Areas

No major problems exist at this time.

### 3.2.8.3 Plans for Next Quarter

#### A. Program Development

1. Develop program requirements for digitized biomedical data.
2. Continue to maintain cognizance of status of the MCC display system development plans and the effect on the CCATS.
3. Provide development support for new CCATS Version IV Program Requirements as required.

#### B. Program Requirements Documentation

1. Continue to update requirements for CCATS Program Requirements, Version IV; CCATS Program Configuration Requirements, Mission H-2; GSFC/MSD Communications Program Interface Control Document (CPIC); and the *Communications Processor Operators Handbook*, (CPOH).
2. Develop and publish the original issue for Mission H-2 CCATS Program Configuration Requirements.
3. Develop data tapes for the numerous tables listed in the CCATS Program Requirements for Version IV. The CCUAS Program will be utilized.

#### C. Maintenance and Operations

1. Update the following documents:
  - CCATS Operations Directive.
  - CCATS Mission Support Certification Criteria.

- CCATS SCU Standard Operational Configuration Criteria.
  - CCATS SCU Operational Confidence Testing Specification.
  - CCATS Computer Center Emergency and Disaster Plan.
2. Furnish, for Mission H-2, the CCATS Training Requirements Forecast, the CCATS Training Implementation Plan, and the *CCATS Mission Certification Book*.
  3. Continue development of the CCATS Operational Training Curriculum Guide as information becomes available.

### 3.2.9 TO-3960, CCATS Hardware Support

#### A. Specific TO's

1. TO-3961, High Speed Printer Survey. Report and specifications have been prepared and are presently in engineering review.

#### B. Specific EO's

1. EO-3172. Installation completed 31 August. TPS's completed on 30 September and 20 August. Awaiting completion of EO-4204 in order to remove a CCATS GFE riser (no TPS required).
2. EO-4903. EI 3 was released on 11 December. Power supply and logic drawer fabrication and assembly drawings are released. Logic diagrams are being checked by Drafting. Cabinet wirelists are released. Power supply schematics are in Engineering check. Cabinet assembly drawings in process by Drafting. First cabinet (OA1678) was released by EO-3968 to Manufacturing on 5 December. Manufacturing effort began 17 December. Majority of SR's and PO's have been placed. Kitting of parts is in process. Preparation of AT approximately 75 percent complete by Engineering. Rough draft is in Technical Publications. Logic drawer wirelists are being finalized. Acceptance Test on high speed printer was accomplished satisfactorily at vendors on 22 December.

3. EO-4904. Implementation of the A and B comm processors has been accomplished. System C is awaiting downtime to implement.

### 3.3 SUPPORT SYSTEMS

#### 3.3.1 General TO-5110, Simulation Programming

##### 3.3.1.1 Progress During Quarter

- A. SIM ALDS. During this quarter, the SIM ALDS Program has been configured for both Mission H-1 and Mission H-2. These programs were validated and delivered within the time required by NASA, with H-2 being delivered 2 weeks ahead of schedule. Work was also started on the conversion of SIM ALDS to run on the UNIVAC 1218.
- B. EXEC 18. The Executive Program for the U418/1218 was nearly completed when work on it was suspended in favor of 494 conversion. This judgment was made because NASA plans at that time were to remove the UNIVAC 418.

##### 3.3.1.2 Problem Areas

No major problems exist at this time.

##### 3.3.1.3 Plans for Next Quarter

- A. SIM ALDS. Work will proceed on the 1218 conversion. The target date for completion of this conversion is 1 April 1970.
- B. EXEC 18. Since it now appears that the plan to replace the UNIVAC 418 with a 494 has been aborted, development of EXEC 18 will be resumed and this program will be placed in service in the first quarter of 1970.

#### 3.3.2 General TO-5111, Simulation Programming (DIP)

##### 3.3.2.1 Progress During Quarter

- A. DIP Test 1. Conversion of DIP Test 1 to operate on the UNIVAC 494 was about 50 percent complete.

- B. DIP Test 6. Conversion of DIP Test 6 to operate on the UNIVAC 494 was about 60 percent complete.
- C. DIP Test 8. Conversion of DIP Test 8 to operate on the UNIVAC 494 was about 30 percent complete. A presentation was made to NASA outlining future plans for DIP Test 8.

### 3.3.2.2 Problem Areas

No major problems exist at this time.

### 3.3.2.3 Plans for Next Quarter

- A. DIP Test 1. Conversion to U494 will be suspended. Work will begin to prepare a DIP Test 1 program on U418 to support Mission H-3.
- B. DIP Test 6. Conversion to U494 will be suspended. A 418 conversion of DIP Test 6 will be made to support Mission H-2, and work will start to prepare a 418 conversion to support Mission H-3.
- C. DIP Test 8. Conversion to U494 will be suspended. A 418 conversion of DIP Test 8 will be made to support Mission H-2. Work will begin to provide an augmented DIP Test 8 to run on the UNIVAC 418 in support of Mission H-3.

### 3.3.3 General TO-5120, SSB Requirement Generation

#### 3.3.3.1 Progress During Quarter

- A. Published Changes 2 and 3 to SSB-404 and Rev. A to SSB-400.
- B. Completed APCU and GSSC program requirements for Mission H-2.
- C. Completed APCU and GSSC testing and checkout for H-1.
- D. Commenced APCU and GSSC program requirements for H-3.
- E. Commenced APCU and GSSC testing and checkout for H-2.



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- F. Reallocated tasks within the unit to conform to reduction in personnel.

#### 3.3.3.2 Problem Areas

No major problems exist at this time.

#### 3.3.3.3 Plans for Next Quarter

- A. Complete requirements for Mission H-3.
- B. Complete testing and checkout for Mission H-2.
- C. Commence testing and checkout for Mission H-3.
- D. Publish appropriate changes to SSB's 400 and 404.
- E. Prepare preliminary display and control requirements for AAP.

#### 3.3.4 General TO-5130, Support Systems Programming

##### 3.3.4.1 Progress During Quarter

- A. Coding was completed for the six programs in the Ground Script System.
- B. Debug and checkout was completed on five of the six programs.
- C. Three static CISS data tapes were generated and delivered to NASA.
- D. The Mission H-2 Apollo confidence tapes were generated, validated and delivered to NASA.
- E. The ALSEP III confidence tapes were generated, validated and delivered to NASA.

##### 3.3.4.2 Problem Areas

No major problems exist at this time.

#### 3.3.4.3 Plans for Next Quarter

- A. Complete checkout and validation of the CADFISS data tapes and CISS Dynamic data tapes.
- B. Generate and validate the Mission H-3 Apollo confidence tapes.
- C. Update the CISS data tapes to Mission H-2.

#### 3.3.5 TO-5131, PEAK CCATS Support Tasks

##### 3.3.5.1 Progress During Quarter

Evaluations have been conducted for 20 different configurations of parameter loading for CCATS support of the AAP program.

##### 3.3.5.2 Problem Areas

No major problems exist at this time.

##### 3.3.5.3 Plans for Next Quarter

The final report is being documented and will be delivered this quarter.

#### 3.3.6 General TO-5132, Support Systems Programming

##### 3.3.6.1 Progress During Quarter

- A. Section personnel supported all ALSEP I simulations.
- B. The ALSEP I program specification documentation was completed in draft form.
- C. Development of the ALSEP III math model system was initiated, Programs for the CCGE and CPLEE experiments have been designed, coded and are presently in the debug stage.



### 3.3.6.2 Problem Areas

No major problems exist at this time.

### 3.3.6.3 Plans for Next Quarter

- A. Complete debug on the CCGE and CPLEE experiment programs.
- B. Design, code and debug a program for the heat flow experiment (HFE).
- C. Deliver to NASA the complete ALSEP III math model system.
- D. Support ALSEP III simulations as required by NASA.
- E. Commence design work on ALSEP IV math model program.

### 3.3.7 General TO-5140, Systems Test Development and Operations

#### 3.3.7.1 Progress During Quarter

- A. The Mission H-2 (Rev. 2) CCATS telemetry data base tapes were generated and validated for use by the DGEN system.
- B. The Mission H-2 command data tape was generated and validated for the DGEN system.
- C. The Mission H-1 CADFISS data base was manually updated to Mission H-2 (Rev. 2).
- D. Two data DR's were opened and closed during the quarter.
- E. Section personnel provided approximately 600 hours of DGEN computer support for various NASA, UNIVAC and PHO tests. This figure includes approximately 140 hours of support during implementation and checkout of the SCU.

#### 3.3.7.2 Problem Areas

No major problems exist at this time.

3.3.7.3 Plans for Next Quarter

- A. Complete the building and verification of the Mission H-2 CADFISS data base tapes.
- B. Update all DGEN data base tapes as required by NASA.
- C. Continue to provide DGEN computer support as required by the 494 computer schedule.

3.3.8 TO-5150, TO-5160, TO-5170, Programming Specification (GSSC/APCU/SSP)

A. GSSC Programming Specifications (TO-5150)

- 1. SSB-401, SLV Model, Volumes 1 and 2, Rev. A, Change 1, was delivered 22 December.
- 2. SSB-405, Project Apollo 500 ASCATS Operations, original issue, was delivered 17 December.
- 3. SSB-403, CSM Model, Rev. 1, Change 1, was delivered 9 December.
- 4. SSB-402, LM Model, Rev. A, was delivered 30 October.
- 5. SSB-404, D/TV Displays, Change 2, was delivered 9 October.
- 6. SSB-400, General, Rev. A, was delivered 6 October.

B. APCU Programming Specifications (TO-5160). There was no scheduled work to be accomplished under this task during this reporting period.

C. SSP Programming Specifications (TO-5170)

- 1. SSB-202, Support Systems Data Generation and Validation Program Specifications, Change 1, was delivered 19 December.

2. SSB-201, CISS Program Specifications, Volume 1, Rev. 2, Change 2, was delivered 9 December.
3. SSB-202, Support Systems Data Generation and Validation Program Specifications original issue, was delivered 11 November.
4. A tentative schedule was submitted for the publication of COST, PRESIM, and ALERT for SSB-203. Publication of SSB-203 is currently scheduled for 18 February 1970 with PRESIM and COST sections to be published 15 January 1970.
5. SSB-200, SSP Programming Requirements Specification, Change 7 (DIP Test 8) was delivered 16 December 1969.
6. DIP Tests 1, 2, and 6 were prepared for publication and submitted for engineering review. Delivery is contingent upon completion of engineering review.
7. Section 2 (Mission Evaluator/CCATS Interface Program) was received from engineering review and approved for publication.
8. Section 5 (SIM ALDS) was currently undergoing rewrite to incorporate program additions and was tentatively scheduled for PHO engineering review 9 January 1970.

### 3.3.9 General TO-5180, APCU

#### 3.3.9.1 Progress During Quarter

##### A. APCU

1. Updates to PHO-TR257, APCU programming documentation, for Mission H-1 were delivered to NASA.
2. Programmer and GACC operator support for Mission H-1 simulations and checkouts ended on 10 November.

3. Implemented nine new or changes to requirements in the Mission H-1 program package during the quarter. A total of 85 new requirements or changes to requirements were implemented during the life span of the Mission H-1 program.
  4. Delivered the Mission H-2 test plan and test procedures to NASA.
  5. Reassembled the Mission H-2 program and generated GO-TAPES 291 and 293 which are currently being system tested.
  6. Implemented 46 new requirements or changes to requirements in the Mission H-2 program package.
- B. DIP 2 (APCU Display Test). Development and testing of DIP 2 is in a hold state. Conversion of DIP 2 from the U418 to U494 computer is in process.
- C. DIP 3 (APCU Telemetry Test)
1. Completed the initialization required for Mission H-2 and currently supporting APCU Mission H-2 system testing.
  2. Development continued during quarter with the following capabilities added to DIP 3 test:
    - Formatter to provide ALDS data (40.8 Kb)
    - Special processing tests (SLV command history, PLSS, single/sector word dump, etc.)
    - GSSC control word and tracking radar data simulator
    - Faulting capability on a frame, word and bit basis for the 36 and 40.8 Kb formatters.

- D. DIP 5 (APCU Command Test). Completed required H-2 initializations, and currently supporting Mission H-2 APCU system testing. Development in a temporary hold state while conversion from U418 to U494 computer is in process.
- E. Confidence Tape Validation Program. Completed validation of the Mission H-2 confidence tapes. Development of additional validation routines using the script tape is in process.

### 3.3.9.2 Problem Areas

No major problems exist at this time.

### 3.3.9.3 Plans for Next Quarter

#### A. APCU

1. System testing of the Mission H-2 program package will be completed and will be used to support Mission H-2 simulations. Projected delivery date of Mission H-2 GO-TAPES was 2 January 1970.
2. Development of the Mission H-3 program package will be completed and system testing of the package will start.
3. Implementation of new requirements will continue on an as received basis.
4. Mission H-3 test plan and test procedures will be delivered to NASA.
5. Implementation of APCU event history processor and updating of the background programs will continue.

- B. DIP 2. Development is scheduled to be restarted. Limited support of Mission H-3 APCU display testing is projected.

- C. DIP 3. Mission H-3 initialization scheduled to be completed for support of Mission H-3 APCU system testing. Development and implementation of additional telemetry tests will continue.
- D. DIP 5. Development is scheduled to be restarted with Mission H-2 changes receiving emphasis.
- E. Confidence Tape Validation Program. Implementation of LVDC script tape validation scheduled to be completed. Documentation will continue.

### 3.3.10 General TO-5100, ASCATS System Engineering

#### A. General

- 1. APCU Phaseover. Engineering completed a study to determine the impact of relocating APCU functions within the CCATS System/C. This study was presented to the NASA.
- 2. MODE Training Class. Engineering conducted five class meetings (approximately 4 hours per class) onsite to familiarize M&O with the two MODE units.
- 3. CAI Test Bed. Work has commenced on a CAI test bed system. Certain hardware and software aspects are being investigated.
- 4. Capabilities Study. A capabilities study is underway to determine system deficiencies, identify improper system usage, and make recommendation relative to increasing system efficiency and performance.
- 5. M&O Support. Approximately 110 hours of engineering effort were provided to the M&O team in support of ASCATS hardware.

**B. Specific TO's**

1. TO-5201, CST/ASCATS Interface Study. This TO has been delivered to NASA FSD and is currently awaiting FCD feedback.

**C. Specific EO's**

1. EO-6201, STREU "C". STREU "C" has been successfully fabricated and an acceptance test performed. The rack has been shipped to site and on-site checkout will continue for approximately two weeks.
2. EO-6202, Building 5 MCC Trainer. Efforts on this EO have been successfully completed.
3. EO-6203, FSMR. This EO has been revived and preliminary efforts are underway.
4. EO-6207, Equipment Removal from Building 422. Installation has started removing cable from Building 422. EI No. 7 was released authorizing EO-6203 to remove FAF equipment.

### 3.4 INFORMATION SYSTEMS DIVISION

#### 3.4.1 TO-7702 Analysis of Communications System Capabilities For MCC Communications Support

##### 3.4.1.1 Progress During Quarter

- A. Engineering Support for Space Communications. The investigation was continued into the detection and elimination of impulse noise. Several methods of eliminating impulse noise were considered and investigated, including delta modulation and signal correlation techniques. After the required circuitry was designed and implemented, the system performance (SNR and BER) resulting from the use of these techniques was evaluated. In addition, a television subcarrier extraction system was investigated. The frequency response of the system was evaluated, and an equalizer network was designed for the purpose of providing more linear system operation. Also, the performance characteristics of a proposed ALEM system design were investigated.
- B. Apollo S-Band Communications Test Predictions. Theoretical test predictions were generated in direct support of the LM compatibility test program. The final calibration predictions for the LM S-Band down-link telemetry tests, conducted during the EVCS test sequence of the LM Phase III tests, were completed and delivered to NASA (EE-8). Final calibration predictions were also completed and delivered for the LM S-Band relay of EVCS voice and data. The preliminary calibration predictions for the LM PRN code suppression and PRN code correlation voltage were completed. Predictions were included for 99.9 percent probability of code acquisition as a function of up-link combination and ground station total received power. The calibration ranging predictions were finalized and delivered to NASA (EE-8). In addition, LM down-link Combination 8 telemetry predetection SNR predictions were generated, using an EVA link and removing the baseband voice. Work continued on the preparation of the final prediction document, which will incorporate all of the previously delivered final test predictions.



- C. Space Vehicle Communications System Signal Design Analysis. An investigation of various analog and digital signal modulation and demodulation techniques was completed. Required values of bandwidth and signal-to-noise ratio were calculated for these techniques. Various combinations of AM, FM, and PM were considered during the investigation. The results of this project were presented in the STS communications system technical memorandum "Optimum Transmission of a Single Voice Signal and 50 Kbps Telemetry Data." The delivery of this memorandum to NASA (EE-8) completed the work effort and the corresponding action document was closed out on 1 December 1969.
- D. Space Shuttle-to-Ground Terminal (via Intelsat IV) Communications System Design and Implementation Characteristics. A task was initiated on 26 September 1969 for the purpose of providing two sets of detailed block diagrams for the C-Band space shuttle communication system. The first set of diagrams represents a system utilized for either FM voice or PCM telemetry. The second set represents a system utilized for either coded delta modulation for voice or coded PCM telemetry. Initial block diagrams were completed and delivered to NASA (EE-8) for both system concepts. A revision of the first set of diagrams (FM voice and PCM telemetry) was initiated after additional design information became available. This revision was completed, and an additional sheet was added for the purpose of illustrating all of the STS communication systems. The investigation of specific areas of interest concerning the STS communication system design was continued.
- E. Advanced RF and Optical Hardware Study. The final report, entitled *Advanced RF and Optical Hardware Study, 1 to 300 GHz and 0.1 to 100μ* (PHO-TN379), was completed and delivered to NASA (EE-8). This report presents the results of a study of currently available and projected 1980-available space-qualified RF hardware in the frequency range of 1 to 300 GHz, and gives information on current and projected optical communications hardware in the 0.1 to 100μ wavelength range. The study considers hardware items such as

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millimeter wave sources, millimeter wave receivers, general RF equipment (mixers, multipliers, amplifiers, and oscillators), optical oscillators, optical modulators, and optical receivers. The delivery of the final report completed the work effort for this project, and the corresponding action document was closed out on 13 October 1969.

- F. Lunar Far-Side Communications. A task was initiated on 3 November 1969 for the purpose of reviewing the basic geometric considerations involved in the libration point relay satellite configurations, and investigating the basic feasibility of using libration point relay satellites for lunar far side communications. The basic geometry of the five Earth-Moon libration points was described and the stability of these points was investigated. Two different communication configurations were proposed and discussed. Communication link calculations were performed for the purpose of illustrating communication system performance and to give an insight into the required system parameters. The results of this investigation were presented in the technical memorandum "Lunar Far Side Communication System." A more detailed investigation of libration point relay satellites for lunar far side communications has been initiated.

#### 3.4.1.2 Problem Areas

No major problems exist at this time.

#### 3.4.1.3 Plans for Next Quarter

- A. Engineering Support for Space Communications. The investigations concerning the ALEM system design and impulse noise elimination will continue. The design of special purpose circuit elements will also continue.
- B. Apollo S-Band Communications Test Predictions. Theoretical predictions based on the NASA (EE-8) unified S-Band math model will continue to be generated on an "as required" basis for the LM test program. The preparation of the final prediction document, which will incorporate all of the previously delivered final test predictions, will continue.

- C. Space Shuttle-to-Ground Terminal (via Intelsat IV) Communications System Design and Implementation Characteristics. The investigation of system design concepts for the STS communication system will continue. Detailed block diagrams of the system concepts will be prepared. These diagrams will be revised on an "as required" basis to include new design information.
- D. Lunar Far-Side Communications. The investigation of libration point relay satellites for lunar far side communications will continue. Additional aspects such as communication coverage,  $\Delta V$  requirements, lifetime, deployment, link margins, etc. will be investigated in detail.

#### 3.4.2 TO-7706 Systems Engineering and Evaluation

##### 3.4.2.1 Progress During Quarter

- A. PAM Synchronization Study. A rough draft of the above study was completed and delivered to NASA (EE-7). At present, math model development for the leading edge detector is in process to determine the optimum settings for the leading edge sensitivity switch. This study was to determine what effect the controls on the Stellarmetrics Data Formatter has on synchronization acquisition, duration of synchronization, and data accuracy.
- B. FM Threshold Communication System Study. Research into methods for theoretical representation of an FM demodulator has begun. Thought is being given to a computer-aided analysis of the expected data from specified tests presently being performed of several communication systems. These specified tests are presently being conducted by NASA and verification of theoretical results is dependent on the data from these tests.
- C. Voice Channel Specification. Two presentations on the status of this task were given to NASA (EE-7) and various voice channel techniques and types of communication systems were discussed. Research studies have been performed on

military and industrial specification and standards pertaining to performance criteria of voice communication links. The definition of specification parameters, measurement techniques and test configurations for voice channel performance was initiated.

- D. Advanced Intercom System Study. Work was performed in the areas of research of available documents concerning intercom systems; refinement of system concepts and analysis of analog versus digital techniques; and analysis of system configurations, using digital speech processing techniques for the intercom system for the space station/base. A presentation on the status and technical approach was given to NASA (EE-7) on 15 December.
- E. Apollo Communication Configuration Handbook Updates. Published and delivered updates of the CSM color television equipment section to replace the black and white television section. Work was also initiated on researching and updating the LM color television equipment to be included in the handbook.
- F. LM Communication Summary. All work on the LM Communication Summary was completed and this task was closed out.
- G. Specified ARIA Unified S-Band System Characteristics. All research and updating of this study was completed. This task was closed out during this quarter.
- H. MSFN/LM Up-Data Link Back-Up Voice Status Report. Published and delivered to NASA (EE-7) 40 final copies and viewgraph of the ESTP MSFN/LM/EVCS Voice Compatibility and Performance Test Status Review, and the ESTP MSFN/LM PCM Compatibility and Performance Test Status Review.

#### 3.4.2.2 Travel

- A. Charles Dopson and Larry Hirsh visited Philco-Ford C&TS Division in Willow Grove, Penn., 2-3 December. Information was obtained on state of the art and advanced concepts in

digital processing and distribution. Discussions also included methods and techniques for establishing performance criteria of voice communications channel.

- B. Charles Dopson visited Westinghouse Electric Corporation in Baltimore, Md., on 5 December. Information and documentation on LM and CSM color cameras, CSM television monitor and ground color television equipment was obtained for purposes of updating the *Apollo Communication Handbook*.

#### 3.4.2.3 Problem Areas

No major problems exist at this time.

#### 3.4.2.4 Plans for Next Quarter

- A. PAM Synchronization Study. Complete math model development for the leading edge detector for determining the leading edges sensitivity switch, and provide NASA with a final report of this study.
- B. FM Threshold Communication System Study. Evaluate test results of the tests being conducted in the ESTF. Prepare a computer-aided analysis program for computing theoretical results for verification of test results from the ESTF.
- C. Voice Channel Specification. Continue to determine and define specification parameter, measurement technique and test configuration for voice channel performance. Provide NASA (EE-7) with a draft of the recommended systems along with specification of these voice channel systems.
- D. Advanced Intercom System Study. Give monthly presentation to NASA (EE-7) on the development and status of this study, and work in the areas of development of operational and functional requirements, development of conceptual design in block diagram form, and expansion of conceptual design to include sketches of exchanges, instruments, etc.

- E. Apollo Communication Configuration Handbook Updates. Complete the updates on the LM color television equipment and provide these updates to NASA (EE-7). Continue updating the *Apollo Communication Configuration Handbook* and provide NASA with these updates when they become available.
- F. MSFN/LM Up-Data Link Back-Up Voice Status Report. Complete the evaluation of the LM Phase III tests and provide NASA with a final report on the test results.

### 3.4.3 TO-7707

#### 3.4.3.1 Progress During Quarter

- A. The Technical Note "Space Shuttle Display/Control Guidelines" of 18 November 1969 was updated as a result of discussions with members of the information Systems Division. The updated version was published as Information Systems Division Internal Note MSC-01282, 12 December 1969.

On 3 December 1969, Technical Note 2, "Space Shuttle Cockpit Display and Control Concepts" was completed and forwarded to ISD. This paper outlined three cockpit configurations for the Space shuttle and the display and control schemes for each. Comments from ISD were received and will be incorporated into an updated edition of this Technical Note.

- B. The SBCC display/control design guidelines is 90 percent completed and is now in the final editing and production phase.

#### 3.4.3.2 Problem Areas

No major problems exist at this time.

#### 3.4.3.3 Plans for Next Quarter

- A. Publish an updated revision of Technical Note 2 incorporating comments of ISD.
- B. Publish SBCC Display/Control Design Guidelines.

#### 3.4.4 TO-7708, Raster Converter/Hardcopy System for the DTDS

This effort is complete.

#### 3.4.5 TO-7709, Raster Converter/DTDS Integration Project

This effort has been stopped pending completion of the equipment move, and additional negotiations with the NASA task monitor.

### 3.5 SCHEDULE III EO'S

#### 3.5.1 General EO's, FSD General Tasks

- A. EO-1832. Category 8.
- B. EO-1846. EO is category 4, parts were received from vendor, rejected, returned to vendor, and new delivery is scheduled for 15 January 1970.
- C. EO-1849. Scheduled implementation completion date is 15 January 1970.
- D. EO-1850. Final installation is dependent on NASA approval of Form 4730. An interim barrier was installed prior to Mission F.
- E. EO-1851. The EO is category N--hold all effort.
- F. EO-1861. Category N--hold all effort.
- G. EO-1866. All areas have been implemented except ALSEP racks. This remaining effort will be implemented prior to the Mission H-2 freeze.

#### 3.5.2 Display Engineering

##### A. Specific EO's

- 1. EO-3047, Seismic Recording System (ALSEP). This EO is complete. Write-up of performance specification is in progress.
- 2. EO-3050, Igniter Modifications. This effort is continuing on a non-interference basis. Thirty of 40 units have been completed.
- 3. EO-3053, D/TV Buffer Modification. The final test was completed on 30 October. Final documentation was completed in December.



4. EO-3056, Chart Recorders Modification. Completed 1 October. Second-floor TPS completed 5 November. Third-floor TPS completed 6 November.
5. EO-3058, Eidophor Status Panel. EI No. 2 was released on 5 November to provide for modification of the EP 21 and color projector. This effort was completed on the third floor in December.
6. EO-3059, D/TV Buffer Clear. Installation is proceeding on a non-interference basis, but will require delivery of additional parts for completion.
7. EO-3061, Modification to ACPD's and D/TV Power Supplies. This EO was completed and tested on 17 November. Final documentation was completed in December.
8. EO-3063, Installation of GFE Hardcopiers. This EO is in hold pending arrival of the GFE hardcopiers.
9. EO-3066, Replacement of Hardcopier Clutches. This EO is complete and is awaiting final documentation.
10. EO-3067, Refurbishment of GFE D/TV Equipment. The side panels and doors are scheduled for installation. Additional effort will be performed on a non-interference basis in accordance with TO-3008.
11. EO-3502, Capability of Timeline Switches for Both Floors of Hardcopy. Redesign due to EWO-1543. EI No. 4 generated to accommodate EWO-1543. Awaiting installation.
12. EO-3510, Aeromed Switching System. EO received 15 January 1969. EI No. 1 submitted 22 January 1969. EI No. 2 submitted 12 March. Third floor installed 3 May. Third floor RT completed 9 May. Second floor installed 26 June. Second floor replacement flasher installed 13 November. The cardioscopes were bad and were repaired by M&O. Final RT completed 18 December.

13. EO-3520, Rewiring to SIM Control Areas of Consoles 62, 63, 64, and 65, Both Floors. EO received on 4 February. NASA need date 6 July. EI No. 1 prepared and released. EI No. 2 released 28 May. Second-floor effort completed on 11 August. Awaiting third-floor completion.
14. EO-3530, Installation of Seven Single Meter Modules. EO received 22 February. EI No. 1 released 6 March. EI No. 2 released 15 April. EI No. 3 released 9 May. EI No. 4 released 6 August. Final single meter modules installed 19 September. Due to EI No. 4, all seven consoles must be tested or retested. Awaiting test times.
15. EO-3537, Power Switch for the MITE Master Control Rack. Acceptance Test completed at the PHO manufacturing facility on 10 September. Installation completed 25 October.
16. EO-3542, Installation of Two Each D9/5B2 Modules in Console 37, Both Floors. EO received on 17 April. NASA need dates 28 June and 31 October. EI No. 1 released on 20 May. Third-floor installation and testing completed on 11 June. Second-floor installation complete on 3 September. Second-floor testing completed on 25 October.

B. Other Display EO's. None.

### 3.5.3 Timing and Control Engineering

#### A. Specific EO's

1. EO-3294, MSK Standardization. EO received 27 January 1969. EI No. 1 released 26 February and provides for manufacturing of 12 MSK's, six universal type and six existing type. EI No. 2, released 11 April, provides for replacement of relay sockets on all G-type MSK's. All MSK's have been shipped to site. Installation and checkout is complete. Third floor was final tested 9 October. Second-floor RT completed 20 December.

2. EO-3297, Two CCATS Restart Control Modules and Associated Equipment. System was acceptance tested in August and shipped to site. Installation was completed 10 September. Checkout was completed 20 September. EO priority changed to B1 on 15 October.

B. Other Timing and Control EO's. None.

### 3.5.4 Telemetry Engineering

#### A. Specific EO's

1. EO-3312, DACIU for ALSEP. Performance specifications are being prepared. Digital oscillator sent to vendor for warranty repair 29 September; returned on 29 October, sent to NASA calibration on 31 October, and installed 4 November. TPS completed 17 November. All other engineering and documentation efforts are complete.
2. EO-3313, Two DACU's, One Patch Assembly for ALSEP. A performance specification being prepared. All other engineering and documentation efforts are complete.
3. EO-3314, DDDIU for ALSEP. A performance specification is being prepared. All other engineering and documentation efforts are complete.

B. Other Telemetry EO's. None.

### 3.5.5 Communications Engineering

#### A. Specific EO's

1. EO-3635, Installation of Patch Equipment-Final, Rm. 118, Bldg. 45. This EO was completed and signed off.
2. EO-3684, A/G Power Modification. This EO was signed off on 22 December, and is now complete.
3. EO-3727, CCS Assets Inventory. The inventory by Engineering is complete, Drafting has released finished

drawings, and required PHO-TR155 tab runs are estimated 80 to 85 percent complete. Final runs should be available by the end of January. Possible minor discrepancies in the inventory are suspected, but will be resolved with a minimum amount of engineering time.

4. EO-3730, Relocation of Bell Modems and Loopback Switching Capability. This EO was completed and signed off.

B. Other Communications EO's. None.

### 3.5.6 CCATS Hardware Engineering

A. Specific EO's

1. EO-3964. Installation completed 9 October. A TPS has been written.
2. EO-3968. The SCU acceptance test was completed in the PHO Distribution Center on 4 December. The SCU was shipped and installed on-site beginning 6 December. The power-up test was initiated on 8 December. Building validation was completed on schedule on 8 December. The final QTP was published and submitted to NASA on 11 December. System C tests successfully completed 16 December. These tests served as confidence tests to validate the SCU design and interfacing. Systems A and B on-site integration and pre-qualification testing was completed on 29 December. Qualification testing to be scheduled after simulation support is completed.

B. Other CCATS Hardware EO's. None.

### 3.5.7 ASCATS System Engineering

A. Specific EO's

1. EO-6180, ASCATS Move. The patchboard frames will be shipped to AMP where new patchboard will be inserted and appropriate silk screening completed. We are currently awaiting an SR.

B. Other ASCATS EO's. None.

### 3.6 SCHEDULE II EO'S

There are 21 Schedule II EO's which have not been certified as complete. Two remain for logistic work sheets; the remaining 19 require manual revisions which are being accomplished under Schedule III, Option 1.

## SECTION 4

### OPERATIONAL SUPPORT

#### 4.1 FLIGHT CONTROL

##### 4.1.1 Progress During Quarter

###### A. Mission Operations

1. Provided post-mission report for Mission H-1.
2. Provided inputs to the data pack for Mission H-2.
3. Reviewed and submitted comments to the Network Operations Directive for Mission H-2.
4. Submitted comments to the Countdown Demonstration Test and Flight Readiness Test TCP's.
5. Generated long-line requirements in support of AAP from Complex 34 to MCC.
6. Completed the communications constraints for AAP.

###### B. Experiments Systems

1. Continued support of the ALSEP-1 package on the lunar surface, as real-time flight controllers.
2. Completed a final draft of a systems drawing covering the cold cathode ion gauge experiment for inclusion in the ALSEP-3 systems handbook.
3. Completed a final draft of a systems drawing covering the heat flow experiment for inclusion into the ALSEP-3 systems handbook.
4. Submitted recommendations for incorporation of the radiation monitoring task into the ALSEP flight control area and for marriage of the radiation and ALSEP flight control functions.

5. Completed inputs required to update the experiments briefing document.
6. Completed a review of the end item specifications for experiment to be incorporated into the AAP mission, and submitted comments on those items requiring modification or correction.
7. Completed a series of sketches covering the electrical and data interfaces between ATM experiments and spacecraft.
8. Completed a review of the operational data book requirements for the ALEM lunar orbiter experiment for Missions J-1 through J-5.
9. Completed preparation of generic requirements for support of the experiments carried on the ALEM vehicle.
10. Completed inputs to the ALEM systems handbook covering the electrical, communications, and telemetry areas as they pertain to onboard experiments.

C. Mission Control Software

1. Reviewed Mission H-2 SLV operational calibration curves.
2. Updated the operational calibration deck with the Nuclear Particle Detection System (NPDS) calibration for Mission H-2.
3. Calculated the G constants for the gimble angle computations to be employed in Mission H-2 for the CSM Branch.
4. Completed the Flight Control confidence tape scripts for Mission H-2.
5. Drafted a memo to FSD listing the flight control PSRD requirements for Apollo/Saturn V.

6. SR Status

- a. Supported the task group determining the ALEM sim and ALEM subsatellite mission control requirements.
- b. Evaluated efforts concerning S-band communications versus VHF communications system for ALEM sub-satellite system.
- c. Assisted in the development of AAP hardware requirements.
- d. Developed rough order of magnitude cost to display the selected PCM ground station format on MCC Console 24.

7. EDP

- a. Received Sections 2 and 3 of the flight mission rules for Mission H-2 on 22 December and delivered for final review on 24 December.
- b. The mission rules rationale is approximately 85 percent complete and is expected to be completed by 16 January.
- c. Completed the Flight Control Operational Handbook (FCOH) on 24 December.
- d. Completed the SLV Time Lines on 22 December.
- e. Completed Changes 1 and 2 to Revision A of the Directory of Standard Nomenclature.

D. Mission Simulation and Simulation Requirements

1. Prepared and submitted a list of 20 LMS circuit breakers to KSC for implementing closed-loop operation of the circuit breakers whenever overload conditions exist.
2. Attended and participated in numerous MSB script meetings to formulate Mission H-2 simulation objectives.



3. Initiated development of the following Mission H-2 scripts:

- 19 LM math model scripts
- 35 LM flight crew trainer scripts
- 2 CSM math model scripts
- 14 CSM flight crew trainer scripts.

All scripts are currently on schedule with MSB milestones.

4. Participated in seven Mission H-2 simulation checkouts.
5. Prepared and conducted a capcomm briefing to Mission H-2 capcomms on 16 December. A follow-on briefing in MCC to discuss specific D/TV displays is being planned prior to start of simulations.
6. Attended a 40-hour M&O soldering school on 15 to 19 December.
7. Continued development of LM CST DSKY display.
8. Initiated development of LM CST Landing Point Designator (LPD) to be used during the descent phase of the LGC program script.
9. Continued maintenance and upgrading of CST's.
10. Continued development of AAP CST requirements.
11. Conducted CST training in support of CSM and LM flight.
12. Updated CST scripts.
13. Generated and delivered four PLSS tapes for delivery to MILA and GDS.

14. Researched AAP biomedical simulation TM requirements.
15. Issued Mission H-3 APCU/GSSC calibration card decks.
16. Completed Change 7 to APCU/GSSC system for Mission H-2.
17. Completed Mission H-2 RTCC sim calibration curves.
18. Delivered ALSEP-3 sim decks for simulation and mission computers.
19. Submitted Revision A to CSM/LM calibration curves to publication.
20. Submitted MRR for Mission H-2 to CMS at KSC.
21. Four personnel completed a PI workshop in support of future AAP PI material.
22. Continued to prepare for Mission H-2 ALSEP simulations.
23. Implemented the four-tone tape system for CM CST.
24. Implemented gimbal position indicators and G-meter display on CM CST.

E. CSM Systems

1. Refined Olivetti Programma 101 programs for Mission H-2.
2. Prepared ECS drawings for orbital workshop systems handbook.
3. Updated liftoff redline for Mission H-2 consumables.
4. Assembled Mission H-1 mission data for photo reduction and storage.
5. Generated a new Olivetti program for delta P versus delta T for cryogenics.

6. Reviewed Mission H-2 mission rules, malfunction procedures and crew checklists.

7. Finished inputs to Mission H-1 mission report.

F. LM Systems

1. Monitored three vacuum chamber runs for Missions H-2 and H-3 back-up crew members.
2. Refined Olivetti Programma 101 programs for Mission H-2.
3. Updated LM handbook drawings.
4. Finished inputs to the Mission H-1 post-mission report.
5. Reviewed LM 7 crew checklists.
6. Reviewed LM 7 malfunction procedures.
7. Reviewed LM 7 mission rules.
8. There were no mission simulations during December.

G. Travel

1. D. J. McDonald traveled to Palo Alto, California, to discuss the active seismic experiment with the Principle Investigator. The active seismic experiment is scheduled for inclusion in the ALSEP-4 package.
2. H. E. Warden traveled to Huntsville, Alabama, to attend ATM instrumentation planning review meeting.

4.1.2 Problem Areas

No major problems exist at this time.

#### 4.1.3 Plans for Next Quarter

##### A. Mission Operations

1. Construct a communications failure matrix for AAP.
2. Participate in FCD AWG meetings.
3. Support simulations and training for Mission H-2.

##### B. Experiments Systems

1. Continue support of the ALSEP-1 package. Support will be limited to a limited period each day plus 48- to 60-hour termination crossing support.
2. Begin preparation of final inputs to the ALSEP-4 systems handbook.
3. Update the data pack for ALSEP-3 to include items which experience with ALSEP-1 indicates are desirable.
4. Update the data pack for the data room on the MOW second floor.
5. Continue inputs to the ALEM systems handbook.
6. Continue support of the ATM systems handbook effort.

##### C. Mission Control Software

1. Participate in all tests that are Flight Control supported.
2. Provide revisions and baseline documentation as required.
3. Review D/TV formats as required.
4. Continue development of SR's.

##### D. Mission Simulation and Simulation Requirements

1. Man and operate assigned simulation consoles in support of all scheduled Mission H-2 simulations and checkouts.

2. Continue development of Mission H-2 scripts.
3. Continue to conduct training exercises on both CM and LM cockpit trainers.
4. Continue development of CST scripts.
5. Continue development of CST requirements in support of AAP.
6. Continue PI development as assigned.
7. Continue development of simulation system requirements.

E. CSM and LM Systems

1. Participate in Mission H-2 simulations.
2. Participate in SESL vacuum chamber runs for Missions H-2 and H-3 crew members.
3. Update mission rules, crew procedures, and crew check-lists.
4. Update systems handbook drawings.

## 4.2 DISPLAY FORMAT AND SLIDE PRODUCTION

### 4.2.1 Progress During Quarter

#### A. Mission Support

1. Mission H-1. Mission support progressed smoothly. All display requirements were completed and delivered.
2. Mission H-2. 88 percent complete at present.
3. Mission H-3. 70 percent complete at present.
4. Publications
  - PHO-TR170B, Vol. I - published Revisions 41 thru 45
  - PHO-TR170B, Vol. II - published Revisions 17 and 18
  - PHO-TR170B, Vol. III - published Revision 6
  - PHO-TR407B, Vol. I - published Revision 4
  - PHO-TR147, Revision C - published Change 2; Change 3 is in work.
5. ALSEP
  - ALSEP I - 70 percent complete at present
  - EASEP II - complete
  - ALSEP III - 75 percent complete at present
  - ALSEP IV - 50 percent complete at present.
6. DSCOP/Gerber. A detailed review of all coded formats is underway for Mission H-2 and subsequent missions. The DSCOP/Gerber system went operational November, 1969. All D/TV mattes are now being produced on the Gerber.

7. DRAFT. The following was accomplished in connection with the development of the DRAFT system:
  - Performed an interim DRAFT acceptance test with satisfactory results
  - Provided a version of DRAFT for training and evaluation
  - Determined a schedule for phasing DRAFT into a completely operational system
  - Generated and delivered to IBM specified display format tapes for program checkout
  - Character font study for optimizing characters for the DTE and Gerber plot systems is being conducted.
8. Display/Control System Performance Evaluation. The following was accomplished in connection with the Display/Control System evaluation using DRIP/DRAP and the development of a DRIP/DRAP replacement program (PEP).
  - The final report (PHO-TN383) for Mission F/Mission C/Mission A(502) was delivered to NASA
  - The final report (PHO-TN401) for Mission G was delivered to NASA
  - Computer runs for data reduction of Mission H-1 data is in progress
  - A GPSS simulation model of the RTCC D/TV system is complete and will be calibrated when statistical data is available from the other performance evaluation program (PEP) modules
  - The data selection program (DSP) and the data retrieval program (DRP) modules of PEP are in the program debug stage.

**B. Special Support**

1. Splashdown Displays. Two special splashdown displays were designed for Mission H-1. A total of 10 mylar mattes were required for the color separations needed on these displays.
2. Eidophor Mirror Coatings. Much effort was expended this month by the high vacuum group toward development of an in-house capability to resurface the expensive Eidophor mirrors. Many coatings were made with various levels of success.
3. Switch Contact Evaluation Prints. A total of 80 photo-micrographs of contact switch points were produced. Work was required on EO-1660.
4. Hardcopy Screen. Two precision artworks and several high resolution slides were produced for hardcopy and TV flare reduction studies. A total of 800 line per inch screens were produced on these D/TV slides.
5. D/TV Slide File Lens Coatings. This project has been on hold during December due to Apollo 12 work loads and Eidophor research.

**C. Production Summary**

1. Designed 332 D/TV formats.
2. Designed 34 projection plotting formats.
3. Designed 6 X-Y plotboard formats.
4. Designed 33 high speed printer formats.
5. Designed 10 reference slide file formats.
6. Designed 186 DRK subformats.



7. Produced 11,885 D/TV slides.
8. Produced 124 projection plotting slides.
9. Produced 457 DRK reticles.
10. Produced 8 projection readout reticles.
11. Produced 7 IEE reticles.
12. Made 362 vacuum depositions.
13. Cleaned 112 hardcopy heads.
14. Produced 156 mylar mattes for D/TV and projection plotting requirements.

#### 4.2.2 Problem Areas

- A. Gerber. Malfunctions with the Gerber caused downtime from 24 November through 2 December. This is the second time that the Gerber has been down (within the last 2 months) for a sustained period of time. A backup source for the Gerber Plotter will be investigated.
- B. DSCOP. Phase over to DSCOP is being accomplished now. Repeated DTDS equipment failures make it extremely difficult to utilize DSCOP as an operational tool. A much higher confidence factor in equipment must be developed.
- C. DRAFT. DFE familiarization has been temporarily interrupted beginning 8 December until the equipment has been moved and checked out again.

#### 4.2.3 Plans for Next Quarter

- A. Complete all planned mission D/TV, P/P, and X-Y plotboard formatting and production requirements.

- B. Publish revisions to PHO-TR170B and PHO-TR407B.
- C. Publish Change 3 to PHO-TR147, Revision C.
- D. Continue training 1 to 3 operators on Gerber 1032 automatic drafting machine and continue the development of operational procedures.
- E. Continue providing programming requirements for DRAFT II and continue familiarization with DRAFT consoles when the system is up.
- F. Continue research in high vacuum coatings for Eidophor mirrors.
- G. Initiate D/TV lens coating project.
- H. Continue DRAFT and PEP development.

#### 4.3 REAL-TIME COMPUTER COMPLEX PROGRAM

##### 4.3.1 Progress During Quarter

- A. Command Program Requirements. Published Change 32 to PHO-TR170A, Volume 4, Revision 1. This change affected Mission G.
- B. Trajectory Program Requirements. Published Changes 91, 92 and 93 to PHO-TR170A, Volume 2. These changes affected Mission G.
- C. Operations Support Plan. Prepared, for NASA publication, Change 5 to MSC Internal Note No. 69-FS-2, *Mission G Support Plan*.
- D. ALSEP Applications Software Requirements. Published Changes 9 thru 11 to PHO-TR407A. These changes made minor documentation corrections and added requirements for ALSEP-IV.
- E. Apollo Guidance Computer Program Requirements for AAP Missions. Published Changes 1 and 2 of PHO-TR442, Volume 1, *CMC Program Requirements*.

##### 4.3.2 Problem Areas

No major problems exist at this time.

##### 4.3.3 Plans for Next Quarter

- A. Command Program Requirements. Continue in coordination, correlation, compilation, documentation, and publication of RTCC command program requirements.
- B. Trajectory Program Requirements. Continue in the coordination, correlation, compilation, documentation, and publication of RTCC trajectory program requirements.
- C. Operations Support Plan. Publish Change 6 (Mission H-3) of the MSC Internal Note No. 69-FS-2.



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- D. ALSEP Applications Software Requirements. Continue in the coordination, correlation, compilation, documentation, and publication of the ALSEP Applications Software Requirements.
- E. Apollo Guidance Computer Program Requirements for AAP Mission. Complete the basic document, which will then be updated as necessary.

#### 4.4 MCC FLIGHT OPERATIONS SCHEDULING

##### 4.4.1 Progress During Quarter

###### A. Operations Scheduling

1. Provided planned test activities for H mission consisting of 34 tests, including launch and plus-time activities, using 686 hours of MCC support.
2. Attended test management team meetings and priorities conferences.

###### B. Schedule Formulation

1. Formulated and updated daily the ASCATS schedule consisting of 970 tests.
2. Typed and distributed the MCC master computer schedule and daily updates.

###### C. Statistics

1. Completed 40 statistical equipment utilization reports.
2. Maintained and entered all tests into the central statistical file.
3. Completed revision of the ASCATS equipment block diagram.
4. Continued work on the *Remote Site Equipment Configuration Guide*.
5. Entered tests into the CROSS.
6. Began equipment configuration guide update for CROSS data base.

###### D. Schedule Control

1. Provided daily management of the MCC master computer schedule.

2. Maintained the operations documentation section.
3. Kept status of the network stations during the mission with receipt of 776 status messages.
4. Prepared 172 station release and return-for-support messages.
5. Provided daily updates to the master schedule and added 460 tests on real time.

#### 4.4.2 Problem Areas

No major problems exist at this time.

#### 4.4.3 Plans for Next Quarter

- A. Provide Mission H-2 test planning.
- B. Continue management of the master computer schedule.
- C. Prepare equipment utilization reports.
- D. Continue ASCATS schedule formulation and updating.
- E. Train all personnel for CROSS.
- F. Maintain the MCC and *Remote Site Equipment Configuration Guides* and operations documentation section.

## 4.5 PROGRAM SUPPORT REQUIREMENTS DOCUMENTATION

### 4.5.1 Progress During Quarter

- A. Completed Revision 1 to the AAP PSRD, which consisted primarily of MSFN updates reflecting the present network configuration as well as individual station capabilities.
- B. Completed Revision 18 to the Apollo Saturn V PSRD. This is the final PSRD revision presently scheduled in support of Mission H-2.
- C. Completed a finalized listing and status of Mission H-1 requirements levied on MSC by external agencies via the PSRD.
- D. Completed a technical review of GSFC, DOD and KSC Mission H-1 support response documents to ascertain MSC requirements compliance.
- E. Assisted in the generation of FSR's and requests for LSR's and PLSR's required in support of Mission H-1.
- F. Completed a detailed review of OSRO-distributed AAP PSRD Revision 1 to ensure accurate reflection of MSC-established AAP operational support requirements.
- G. Completed final updating of Mission H-1 and initial issue of Mission H-2 DAP and DAP annex distribution lists.
- H. Administered the distribution of Missions H-1 and H-2 mission-related documentation to appropriate MSFN stations.
- I. Attended several technical reviews convened to define MSC ALEM requirements and commenced research of CSM 113 ALEM requirements for inclusion in the Apollo Saturn V PSRD.
- J. Provided engineering liaison and data services support to the Mission H-1 ASPO mission evaluation team.
- K. Completed a technical review of KSC and DOD Mission H-1 photo test plan to certify proper support of MSC data requirements.

- L. Assisted NASA with the inter-center integration of Mission H-2 operational ground support requirements.
- M. Completed and delivered a summary reflecting MSFN USB station operational capability, a chart indicating MSC/MSFN station support, and another reflecting MSC/MSFN data flow.
- N. Travel. J. Kellett visited MSFN 8-10 December to integrate Mission H-2 MSC operational support requirements.

#### 4.5.2 Problem Areas

No major problems exist at this time.

#### 4.5.3 Plans for Next Quarter

- A. Commence and complete Revision 2 to the AAP PSRD.
- B. Commence and complete Revision 19 to the Apollo Saturn V PSRD.
- C. Complete the MSC input to the GSFC Mission H-2 documentation briefing report.
- D. Assist in the generation of FSR's and requests for LSR's and PLSR's required in support of Mission H-2.
- E. Provide engineering liaison and data services support to the Mission H-2 ASPO mission evaluation team.
- F. Revise and update distribution lists established for PHO-TR and NASA-DAP documents to reflect current requirements.
- G. Continue to administer and coordinate the distribution of mission-related documentation to MSFN stations.
- H. Complete a listing and status of Mission H-2 requirements levied on MSC by external agencies via the PSRD.
- I. Continue with the technical review of applicable support documents prepared in response to Mission H-2 PSRD-established operational ground support requirements.



## 4.6 INSTRUMENTATION OPERATIONS

### 4.6.1 Progress During Quarter

#### A. Tests Supported

1. Supported 34 tests for the H-1 mission totaling 686 hours.
2. Continued ALSEP-1 support since deployment.

#### B. Training

1. Certified all H mission console operators in accordance with the console operator qualification program.
2. Conducted remote site equipment interface and data flow classes for M&O personnel.
3. Attended MCC equipment and data flow classes conducted by M&O personnel.
4. Conducted a course on ALSEP equipment data flow and documentation for customer personnel.
5. Studied three days with GSFC training personnel familiarizing them with MCC equipment, data flow, and console operations.
6. Participated in cross training on the computer supervisor, CP controller, and display control console.
7. Held classes and "paper simulations" on the newly developed MCC troubleshooting procedure flow charts.
8. Reviewed and updated the qualification and certification program to include the ALSEP network controller training requirements for Phases A, B, and C.
9. Attended SCU familiarization class.

### C. Documentation

1. Processed, printed, and distributed the Support Count Handbook (SCH) Network Countdowns 1 and 2 (NC1 and NC2).
2. Printed and distributed the OPS activity plan on a scheduled basis.
3. Maintained updated documentation in the IOD libraries and at the network, ALSEP network, and documentation consoles.
4. Completed and distributed Change 3 to the Flight Support Operations Handbook (FSOH).
5. Printed and distributed Mission Documentation Change (MDC) 1 and 2 to the FSOH.
6. Printed and distributed Volume 4 to the FSOH.
7. Printed and distributed the final H mission Instrumentation Support Plan (ISP) and an errata sheet.
8. Coordinated and submitted final changes to the H mission terminal countdown.
9. Submitted preliminary ISP for Mission H-2; completed Change 1 to the MCC validation manual.
10. Completed and distributed DAP, Annex F, Change 2 for Mission H-2.

### D. General Mission Preparation

1. Participated in test management team activities for Missions H-1 and H-2.
2. Generated the H mission network simulation plan.
3. Participated in review of the FSOH, FCOH, and NOD.
4. Assisted in the development of the air/ground long-line comm guide.

5. Completed the comm configuration manual for all operational support activity.
6. Attended meetings to review operating plans and procedures for high-activity mission phases.
7. Participated in the H mission PHO safety review committee activity.
8. Developed console checklists for the H mission.

#### E. Travel

1. D. Wilson traveled to the Corpus Christi MSFN station to generate portions of the H mission network simulation plan.
2. E. Carr traveled to the Merritt Island MSFN station to participate in the ALSEP-3 software integration test.
3. N. Talbott traveled to TEX to validate the H mission telemetry discrepancy errata.
4. R. Grilli traveled to the Merritt Island MSFN station to participate in RSDP checkout.

#### 4.6.2 Problem Areas

No major problems exist at this time.

#### 4.6.3 Plans for Next Quarter

- A. Continue support of ALSEP-1 and EASEP as required; provide ALSEP-3 support.
- B. Participate in validation tests for Mission H-2.
- C. Participate in Mission H-2 simulation and mission activities.
- D. Provide ALSEP-4 SIT support as required.
- E. Continue training with emphasis on SCU operation/configuration.
- F. Complete update cycle for mission-oriented documentation.

## 4.7 LLTV OPERATIONS

### 4.7.1 Progress During Quarter

#### A. Tests Supported. Conducted the following operations:

- Flights - 27
- Combined system tests, NASA 952 - 2.

The CST for Vehicle 952 was completed; the flight test program on NASA 952 did not begin as planned.

#### B. Training. Supported all flight operations with proficiency drills for Flight Control personnel. Training was conducted as follows:

- Flight Control simulations - 107 hours
- Mission rules and checklist reviews, analysis and discussion of hypothetical flight situations - 133 hours.

LLTV ground school for Astronaut Young was conducted on 13 and 14 October.

#### C. Documentation. Reviewed and updated the handbook of controllers operations procedures and resubmitted to the government on 15 December. The LLTV systems handbook was reviewed and publication delayed at the government's request in order to provide finished engineering drawings rather than the working drafts originally requested.

#### D. General Mission Preparation. Certified two flight controllers.

### 4.7.2 Problem Areas

No major problems exist at this time.

### 4.7.3 Plans for Next Quarter

Continue maintenance of flight controller proficiency, awaiting the return of NASA 951 to flying status, and the commencement of the flight test program for NASA 952.

## SECTION 5

### SUBCONTRACTOR STATUS REPORT

SUBCONTRACTOR	ORDER NUMBER	DESCRIPTION	DATE (NASA) APPROVED
<u>Subcontracts:</u>			
Fisk Electric	PHO-1-361, Amend No. 1 to Task Order No. 1	Elect Installation	N/A
Fisk Electric	PHO-1-361, Amend No. 2 to Task Order No. 2	Elect Installation	N/A
Hazeltine	PHO-1-330, Amend No. 3	Spec Substitution	Open
<u>Blanket Orders:</u>			
Volt Technical Corporation	PHO-B-114	Additional Funding	Open
Master Specialties	PHO-B-162	Switches	12/04/69
Radio Electric	PHO-B-163	Elect Comp and Hardware	N/A
Milgray	PHO-B-165	Integrated Circuits	N/A
T. J. Carter Company	PHO-B-166	Electrical Supplies	N/A
Allied Elec- tronics	PHO-B-167	Elect Comp and Hardware	N/A
Instant Tech- nical Service	PHO-B-168	Temporary Help	Open
Volt Technical Corporation	PHO-B-169	Temporary Help	Open